PROC. BIOL. SOC. WASH.
93(4), 1980, pp. 1035–1079

REVIEW OF *HYSTEROTHYLACIUM* AND *IHERINGASCARIS* (BOTH PREVIOUSLY =*THYNNASCARIS*) (NEMATODA: ANISAKIDAE) FROM THE NORTHERN GULF OF MEXICO

Thomas L. Deardorff and Robin M. Overstreet

Abstract.—The genus *Hysterothylacium* Ward and Magath (type-species *H. brachyurum* Ward and Magath) is resurrected to include those species previously considered as members of the junior synonym *Thynnascaris* Dollfus and others described in the genus *Contracaecum* Railliet and Henry that mature in fishes. *Iheringascaris* Pereira is resurrected for *I. inquies* (Linton), the senior synonym of *I. iheringascaris* Pereira. Consequently, we establish 47 new combinations plus present lists of species that may later be shown to be members of *Hysterothylacium*. At least six species of *Hysterothylacium* [*H. fortalezae* (Klein), *H. incurvum* (Rudolphi), *H. chaunaxi* (Olsen), *H. reliquens* (Norris and Overstreet), *H. ogcocephali* (Olsen), and *H. corrugatum* sp. n.] occur in the Gulf of Mexico, and morphological data and a key are presented for these. *Hysterothylacium corrugatum* infecting the swordfish from the Atlantic and Pacific oceans can be characterized primarily by having modified preanal annules ventrally in males and a tail without ornamentation in conjunction with lacking both deep interlabial grooves and flaring cervical alae.

Several adult nematodes infecting the digestive tracts of finfishes have been described as species of *Thynnascaris* Dollfus, 1933 or *Contracaecum* Railliet and Henry, 1912. Species of *Contracaecum sensu stricto,* however, mature in birds and mammals. Reexamination of *Hysterothylacium brachyurum* Ward and Magath, 1917, as discussed below, reveals it to have the same generic features as species of *Thynnascaris*. Before the genus *Thynnascaris* gains more acceptance, especially in light of potential public health significance of some species (Petter, 1969a, b; Norris and Overstreet, 1976; Norris and Ebert, MS in preparation; Overstreet and Meyer, MS in preparation), we wish to establish the priority of *Hysterothylacium* Ward and Magath, 1917 and *Iheringascaris* Pereira, 1935, transfer known species, and provide data on species of those genera from the Gulf of Mexico.

Most specimens that we collected were removed from hosts, fixed in glacial acetic acid, stored in a solution of 5 parts glycerin and 95 parts 70% ethyl alcohol, and examined in lactic acid or in glycerin after the evaporation of the alcohol. A few others from hosts in museums had been fixed in formalin and transferred to ethyl alcohol. Many of the common names for fishes follow the American Fisheries Society's list (Bailey, 1970). Sections of worms were stained with Harris' hematoxylin and eosin. Measurements locating the position of the nerve ring are taken from the anterior extremity of the worm to the center of the nerve ring. In spicule ratios, the length of the left spicule equals one. All measurements are in micrometers unless stated otherwise, and figures were drawn with the aid of a drawing tube.

Abbreviations for repositories of examined nematodes or host fish are BMNH—British Museum (Natural History), London, England; GCRL—Gulf Coast Research Laboratory Museum, Ocean Springs, Mississippi; MPM—Meguro Parasitological Museum, Tokyo, Japan; OCI—Oswaldo Cruz Institute, Helminthology Collection, Rio de Janeiro, Brazil; SIO—Scripps Institution of Oceanography, La Jolla, California; TABL—Southeast Fisheries Center, NMFS, Miami, Florida; UMML—Rosenstiel School of Marine and Atmospheric Science, University of Miami, Florida; USNM—National Museum of Natural History, Smithsonian Institution (for fish); USNM Helm. Coll.—United States National Museum, Helminthological Collection, Beltsville, Maryland; VIMS—Virginia Institute of Marine Science, Gloucester Point, Virginia; ZM—Zoologisches Museum, Humboldt-Universität, Berlin, Germany.

Hysterothylacium Ward and Magath

Hysterothylacium Ward and Magath, 1917 (type-species *H. brachyurum* Ward and Magath, 1917).

Thynnascaris Dollfus, 1933 (type-species *T. legendrei* Dollfus, 1933, junior synonym of *Ascaris cornuta*).

Thynnascaris.—Dollfus, 1935 (relegated to subgenus of *Contracaecum*).

Simplexonema Kreis, 1952 (as subgenus of *Contracaecum* with *C.* (*S.*) *cyclopteri* Kreis, 1952 as type-species).

Erschovicaecum Mozgovoi *in* Skrjabin *et al.*, 1951 (as subgenus of *Contracaecum* with *C.* [*E.*] *aduncum* [Rudolphi, 1802] as type-species).

Acollaris Araujo, 1970 (as subgenus of *Contracaecum* with *C.* [*A.*] *marinum* [Linnaeus, 1767] as type-species).

Diagnosis.—Body elongate, reaching greatest width near midbody. Cuticle with annulations moderately or weakly defined or lacking (presumably unreported). Cuticular alae distinct or indistinct. Lips approximately equal in size, usually broader than long, bearing transparent cuticular flanges on lateral margins; flanges with or without indentations; internal pulp usually pedunculated; dorsal lip with 2 lateral doubled papillae; subventral lips with amphid, adjacent mediolateral doubled papilla, and single lateral papilla. Dentigerous ridges absent (not present as indicated by Jackson *et al.*, 1978). Interlabia present; interlabial grooves present or absent. Ventriculus nearly spherical; ventricular appendage saclike or cylindrical, with septum dividing structure into 2 equal longitudinal pouches; intestinal cecum usually shorter than ventricular appendage. Excretory system with excretory pore located at or near level of nerve ring, with duct extending to at least left lateral cord in which primary excretory canal extending posteriorly (at least in species examined). Rectal glands present or absent (presumably unreported). Spicules similar, alate, equal or slightly unequal in length. Gubernaculum absent. Vulva anterior to midbody. Uterus didelphic, opisthodelphic. Tail conical; tip with or without ornamentation. Medioventral preanal organ usually distinct on preanal fold. Phasmids usually distinct. Parasites of marine, estuarine, and freshwater fishes. Type-species: *Hysterothylacium brachyurum* Ward and Magath, 1917.

Comparisons.—Species of *Contracaecum,* especially larval forms, are often confused with those of *Hysterothylacium* primarily because some authors still accept *Contracaecum* in its broad sense. In the strict sense as followed here, even larvae can be distinguished because the excretory pore empties near the ventral interlabium in species of *Contracaecum,* adults of which mature in birds and mammals. Most species related to those in *Hysterothylacium* mature in fishes. Those of *Goezia* Zeder, 1800 have plicated cuticular annulations possessing spines along their rear border, at least as adults, and that of *Iheringascaris* to be reviewed later in this paper has similar annulations but without spines. Other nematodes with a ventricular appendage, intestinal cecum, and excretory pore emptying near level of the nerve ring include members of several genera that need further investigation. *Heterotyphlum* Spaul, 1927 and *Paraheterotyphlum* Johnston and Mawson, 1948 (see Schmidt and Kuntz, 1973; Sprent, 1978) have members with no interlabia; *Lappetascaris* Rasheed, 1965 has one species, and it has no interlabia and considerably modified lips; and *Pulchrascaris* Vicente and dos Santos, 1972 also has one species, and it has no interlabia and its lips have dentigerous ridges. The position of the excretory pore and whether a ventricular appendage exists both need to be determined. Species of *Raphidascaris* Railliet and Henry, 1915, presumably without interlabia, and *Raphidascaroides* Yamaguti, 1941, with them, also are similar to those of *Hysterothylacium* except they lack the intestinal cecum.

Remarks.—Dollfus (1933), assuming the type-species lacked a ventricular appendage, erected *Thynnascaris* as a genus, but later (1935a) reduced it to a subgenus of *Contracaecum* Railliet and Henry, 1912 when he realized the appendage was present. Hartwich (1957) resurrected *Thynnascaris,* distinguishing it from *Contracaecum* on the basis of having species that lack a ribbonlike widening of excretory system, have an excretory pore near the level of the nerve ring rather than the ventral interlabium, and mature in fishes rather than in birds and mammals. Yamaguti (1962), basing his classification scheme mainly on the presence of both intestinal and ventricular diverticula, recognized *Contracaecum* as the only valid genus. In other recent classifications, Chabaud (1965) accepted both *Thynnascaris* and *Contracaecum* and placed them in different tribes of the subfamily Anisakinae, whereas Hartwich (1974) placed *Thynnascaris* in Raphidascariinae (as Raphidascaridinae), and *Contracaecum* in Anisakinae.

None of the above authors accepted *Hysterothylacium* as valid. Yamaguti (1962) followed Van Cleave and Mueller (1934) and considered it a junior synonym of the older *Contracaecum,* whereas Chabaud (1965) and Hartwich (1974), following Yorke and Maplestone (1926) and Baylis and Daubney (1926), considered it a junior synonym of *Raphidascaris* Railliet and Henry, 1915. Gibson (1975), in a review of Hartwich's key, questioned the synonymy, but did not resurrect *Hysterothylacium* nor did he intend to do so (Gibson, personal communication). Margolis and Arthur (1979) briefly discussed the problem. *Hysterothylacium* was erected for *H. brachyurum,* which was considered to lack an intestinal cecum, from the stomach of black bass (=largemouth bass) in Lake St. Clair, Michigan (Ward and Magath, 1917). When Van Cleave and Mueller (1934) examined additional specimens from bass in Oneida Lake, they noted an intestinal cecum, the primary character separating *Contracaecum sensu lato* from *Raphidascaris.* Consequently, they considered *Hysterothylacium* a synonym of *Contracaecum* rather than *Raphidascaris.* Hartwich (1957) assumed Van Cleave and Mueller (1934) had a species different from Ward and Magath's. We, however, examined the type (USNM Helm. Coll. No. 52120) of *H. brachyurum* plus additional other specimens (USNM Helm. Coll. No. 55995) and confirm the presence of an intestinal cecum, ventricular appendage, and excretory pore located near the nerve ring. We therefore consider *Thynnascaris* a junior synonym of *Hysterothylacium* in accordance with replaced sections a and b of Article 23 (Anonymous, 1974) of the International Code of Zoological Nomenclature. The name *Thynnascaris* cannot be considered "long-established," and application of the Law of Priority will not disturb stability or cause confusion, points confirmed by W. I. Follett (California Academy of Sciences, personal communication). The junior synonyms of *Hysterothylacium* other than *Acollaris* listed in the synonymy have been discussed by Hartwich (1957). Araujo (1970) established that subgenus to include those species (without naming them) that we consider *Hysterothylacium.*

By accepting the name *Hysterothylacium,* a number of new combinations must be established (Table 1). For a number of other species, some based on adults and some on larvae, we have not seen type-material and are uncertain of their generic relationships or their validity (Tables 2, 3). Even less information is known for several additional species mentioned by Baylis (1923), Dollfus (1935a), and Punt (1941), but not listed in this paper. Tchéprakoff (1966) described *C. prevosti* Tchéprakoff, 1966 from the emperor penguin and reported the excretory pore as opening posterior to the nerve ring. Since we know of no species of *Hysterothylacium* infecting a bird, that observation should be confirmed and evaluated.

Hensley and Nahhas (1975) reported *C. brachyurum* from the intestine and ceca of four fishes in the Sacramento–San Joaquin Delta, California, but their specimens were not readily available for us to examine (Nahhas, personal communication). Numerous other references to records from the northern U.S. and Canada are listed by Hoffman (1967) and Margolis and Arthur (1979).

The only other species described as a member of *Hysterothylacium* is *H. cayugensis* Wigdor, 1918 (see Wigdor, 1918), based on immature females infecting *Esox lucius* Linnaeus and *Ictalurus nebulosus* (Lesueur) (as *Ameiurus n.*) in Cayuga Lake, New York. Van Cleave and Mueller (1934) assumed it was conspecific with *H. brachyurum*. No designated type was located, but specimens (USNM Helm. Coll. Nos. 52121 and 52122) from *Esox lucius* in Lake Cayuga and Douglas Lake, Michigan, deposited in 1917 by Wigdor and by A. R. Cooper, respectively, were identified by Wigdor and Magath as *Hysterothylacium* sp., followed by "(=*Raphidascaris* sp.)" on the label. We keyed those to *Raphidascaroides* Yamaguti, 1941 in Hartwich's (1974) generic key, and consider *H. cayugensis* a *nomen dubium*.

Hysterothylacium fortalezae (Klein), new combination
Figs. 1–13

Contracaecum fortalezae Klein, 1973:200–210, figs. 1–7 (original description; type-host *Scomberomorus brasiliensis*; type-locality Ceará, Brazil).

Diagnosis.—Cuticle with prominent cervical alae; lips with ratio of length to width 1:0.9–1.0; caudal papillar pairs: preanal 13–25; postanal 8; spicules 3–5% of body length; spicule-ratio 1:1.0; tuft of 12–14 relatively large projections at posterior extremity.

General (based on specimens from Mississippi).—Body reaching greatest width near midbody. Cuticle with inconspicuous annulations. Alae extending entire length of body; cervical alae prominent, wing-like, extending from base of lips to level of posterior ⅓ of esophagus, up to maximum of 30–68 thick (on 5 specimens); caudal alae most prominent at posterior extremity. Lips approximately equal in size, as wide as long; flanges widest near posterior; pulp slightly pedunculated. Interlabia with height equal to or slightly greater than width at base; interlabial grooves lacking. Esophagus 6.4–10.0% of body length. Ventriculus narrower than widest level of esophagus, usually longer than wide; ventricular appendage descending without angulation from posterior portion of ventriculus. Nerve ring located adjacent to anterior 22–34% of esophagus. Excretory pore immediately posterior to level of nerve ring. Tail with tuft of projections at posterior extremity.

Male (based on 3 specimens): Body 12.0–23.4 mm long by 141–432 at

Table 1.—List of new combinations in the genus *Hysterothylacium* parasitizing fishes of the world.

New combination	Original name	Pertinent reference(s)
H. aduncum	*Ascaris adunca* Rudolphi, 1802	Hartwich, 1975 (compare Punt, 1941; Petter, 1969b; and other cited references)
H. amoyensis	*Contracaecum amoyensis* Hsü, 1933	Hsü, 1933a, b
H. arii	*Contracaecum arii* Yamaguti, 1954	Yamaguti, 1954
H. assi	*Contracaecum assi* Parukhin, 1973	Parukhin, 1973
H. auctum	*Ascaris aucta* Rudolphi, 1802	Dollfus, 1953; Hartwich, 1975
H. baylisi	*Contracaecum baylisi* Yamaguti, 1941	Yamaguti, 1941
H. bidentatum	*Ascaris bidentata* Linstow, 1899	Mozgovoi, 1953 (*A. stroumovi* Golowin, 1900, as a junior synonym)
H. carangis	*Thynnascaris carangis* Kalyankar, 1971	Kalyankar, 1971
H. chaunaxi	*Contracaecum chaunaxi* Olsen, 1952	Olsen, 1952; this paper
H. clavatum	*Ascaris clavata* Rudolphi, 1809	Kahl, 1936; Osmanov, 1940; Kreis, 1952
H. coiliae	*Contracaecum coiliae* Yamaguti, 1941	Yamaguti, 1941
H. cornutum	*Ascaris cornuta* Stossich, 1904	Baylis, 1923; Dollfus, 1935a; Berland, 1961; Petter, 1969b; Hartwich, 1975 (*T. legendrei* Dollfus, 1933, as a junior synonym)
H. cyclopteri	*Contracaecum* (*Simplexonema*) *cyclopteri* Kreis, 1952	Kreis, 1952 (considered junior synonym of *C. aduncum* by Berland, 1961)
H. dollfusi	*Thynnascaris dollfusi* Schmidt, Leiby, and Kritsky, 1974	Schmidt *et al.*, 1974
H. epinepheli	*Contracaecum epinepheli* Yamaguti, 1941	Yamaguti, 1941
H. fabri	*Ascaris fabri* Rudolphi, 1819	Compare Baylis, 1923; Zhukov, 1960 (*A. biuncinata* Molin, 1858, as a junior synonym)

Table 1.—Continued.

New combination	Original name	Pertinent reference(s)
H. fortalezae	*Contracaecum fortalezae* Klein, 1973	Klein, 1973; this paper
H. gadi	*Ascaris gadi* Müller, 1776	Johnston and Mawson, 1945; Hartwich, 1975
H. gracile	*Contracaecum gracile* Yamaguti, 1935	Yamaguti, 1935, 1941
H. habena	*Ascaris habena* Linton, 1900	Chandler, 1943; Norris and Overstreet, 1975; this paper
H. hapalogenyos	*Contracaecum hapalogenyos* Yamaguti, 1961	Yamaguti, 1961
H. haze	*Thynnascaris haze* Machida, Takahashi, and Masuuchi, 1978	Machida *et al.,* 1978
H. histiophori	*Contracaecum histiophori* Yamaguti, 1935	Yamaguti, 1935; Olsen, 1952; this paper
H. ilishae	*Contracaecum ilishae* Yamaguti, 1941	Yamaguti, 1941
H. increscens	*Ascaris increscens* Molin, 1858	Molin, 1858
H. incurvum	*Ascaris incurva* Rudolphi, 1819	Baylis and Daubney, 1922; Dollfus, 1935b; Hartwich, 1975; this paper
H. longispiculum	*Contracaecum longispiculum* Fujita, 1940	Fujita, 1940
H. magnum	*Contracaecum magnum* Smedley, 1934	Smedley, 1934 (considered probable synonym of *H. aduncum* by Margolis and Arthur, 1979)
H. marinum	*Ascaris marina* Linnaeus, 1767	Yamaguti, 1935
H. melanogrammi	*Contracaecum melanogrammi* Smedley, 1934	Smedley, 1934 (possible synonym of *H. aduncum,* see Margolis and Arthur, 1979)
H. melichthysi	*Contracaecum melichthysi* Olsen, 1952	Olsen, 1952
H. murrayense	*Contracaecum murrayense* Johnston and Mawson, 1940	Johnston and Mawson, 1940
H. ogcocephali	*Contracaecum ogcocephali* Olsen, 1952	Olsen, 1952; this paper

Table 1.—Continued.

New combination	Original name	Pertinent reference(s)
H. okadai	*Contracaecum okadai* Fujita, 1940	Fujita, 1940
H. pagrosomi	*Contracaecum pagrosomi* Yamaguti, 1935	Yamaguti, 1935
H. paralichthydis	*Contracaecum paralichthydis* Yamaguti, 1941	Yamaguti, 1941
H. rectum	*Contracaecum rectum* Yamaguti, 1961	Yamaguti, 1961
H. reliquens	*Thynnascaris reliquens* Norris and Overstreet, 1975	Norris and Overstreet, 1975; this paper
H. rhacodes	*Thynnascaris rhacodes* Deardorff and Overstreet, 1979	Deardorff and Overstreet, 1978
H. rigidum	*Ascaris rigida* Rudolphi, 1809	Punt, 1941; Berland, 1961; Petter, 1969b; Hartwich, 1975 (considered a junior synonym of *C. marinum* by Yamaguti, 1935)
H. saba	*Contracaecum saba* Yamaguti, 1941	Yamaguti, 1941
H. salvelini	*Contracaecum salvelini* Fujita, 1940	Fujita, 1940
H. scomberomori	*Contracaecum scomberomori* Yamaguti, 1941	Yamaguti, 1941
H. seriolae	*Contracaecum seriolae* Yamaguti, 1941	Yamaguti, 1941; Brunsdon, 1956; Machida *et al.*, 1978
H. trichiuri	*Contracaecum trichiuri* Thwaite, 1927	Thwaite, 1927
H. zenis	*Contracaecum zenis* Baylis, 1929	Baylis, 1929
H. zenopsis	*Contracaecum zenopsis* Yamaguti, 1941	Yamaguti, 1941; Brunsdon, 1956

greatest width; ratio of greatest width to length 1:54–85. Lips 43–81 long by 43–80 wide. Esophagus 0.9–1.5 mm long or 6.4–7.8% of body length. Ventriculus 65–127 long by 50–100 wide; ventricular appendage 506–835 long by 24–38 wide; ratio for lengths of ventricular appendage to esophagus 1:1.6–1.8. Intestinal cecum 144–296 long by 43–84 wide; ratio of cecal to ventricular appendage lengths 1:2.1–3.9; ratio of cecal to esophagus lengths 1:5.0–6.5. Nerve ring located within anterior 25.5–29.4% of esophageal, 24–38 in breadth. Spicules 2.9–4.7% of body length, 560–680 long by 14–17 wide;

Table 2.—Species of uncertain status*, but possibly referable to *Hysterothylacium* because they contain an intestinal cecum and ventricular appendage and mature in the alimentary canal of fishes.

Contracaecum filiforme (Stossich, 1904)
Contracaecum macquariae Johnston and Mawson, 1940
Contracaecum macrozarcium Nigrelli, 1946
Contracaecum mulli (Wedl, 1855)
Contracaecum naitoi Fujita, 1932
Contracaecum ochotense Fujita, 1932
Contracaecum serrani Kalyankar, 1972
Contracaecum synpapillus Bilqees, Khanum, and Jehan, 1971

* See text for references to other nominal species with status more uncertain.

spicule-ratio 1:1.0. Caudal papillae 21–33 pairs, becoming closer together and more medial as approaching anus; preanal pairs 13–25; postanal pairs 8; para-anal pairs lacking. Medioventral preanal organ indistinct. Phasmids anterior and lateral to last papillar pair. Tail 129–173 long including 12–14 rounded and pointed projections measuring 9–19 long plus several shorter ones near posterior nonconical extremity.

Female (based on 5 specimens): Body 10.0–15.4 mm long by 144–189 wide at greatest width; ratio of greatest width to length 1:69–92. Lips 48–63 long by 48–63 wide. Esophagus 1.0–1.1 mm long or 7–10% of body length. Ventriculus 72–107 long by 48–86 wide; ventricular appendage 556–661 long by 24–49 wide; ratio for lengths of ventricular appendage to esophagus 1:1.5–2.1. Intestinal cecum 120–166 long by 50–60 wide; ratio of cecal to ventricular appendage lengths 1:3.4–5.4; ratio of cecal to esophageal lengths 1:6.4–8.3. Nerve ring located within anterior 22–34% of esophagus, 31–41 in breadth. Vulva without salient lips, opening 5.0–6.0 mm or 30–38% of body length from anterior extremity. Ovaries not extending beyond anterior level of vulva. Phasmids inconspicuous. Tail 247–284 long including 12–14 rounded and pointed projections measuring 7–18 long plus several shorter ones near posterior nonconical extremity.

Hosts.—*Scomberomorus brasiliensis* Collette, Russo, and Zavala-Camin, serra Spanish mackerel, type-host; *S. maculatus* Mitchill, Spanish mackerel; *S. cavalla* (Cuvier), king mackerel (Scombridae); *Oligoplites saurus* (Bloch and Schneider), leatherjacket (Carangidae); *Mycteroperca bonaci* (Poey), black grouper (Serranidae).

Sites of infection.—Stomach and intestine.

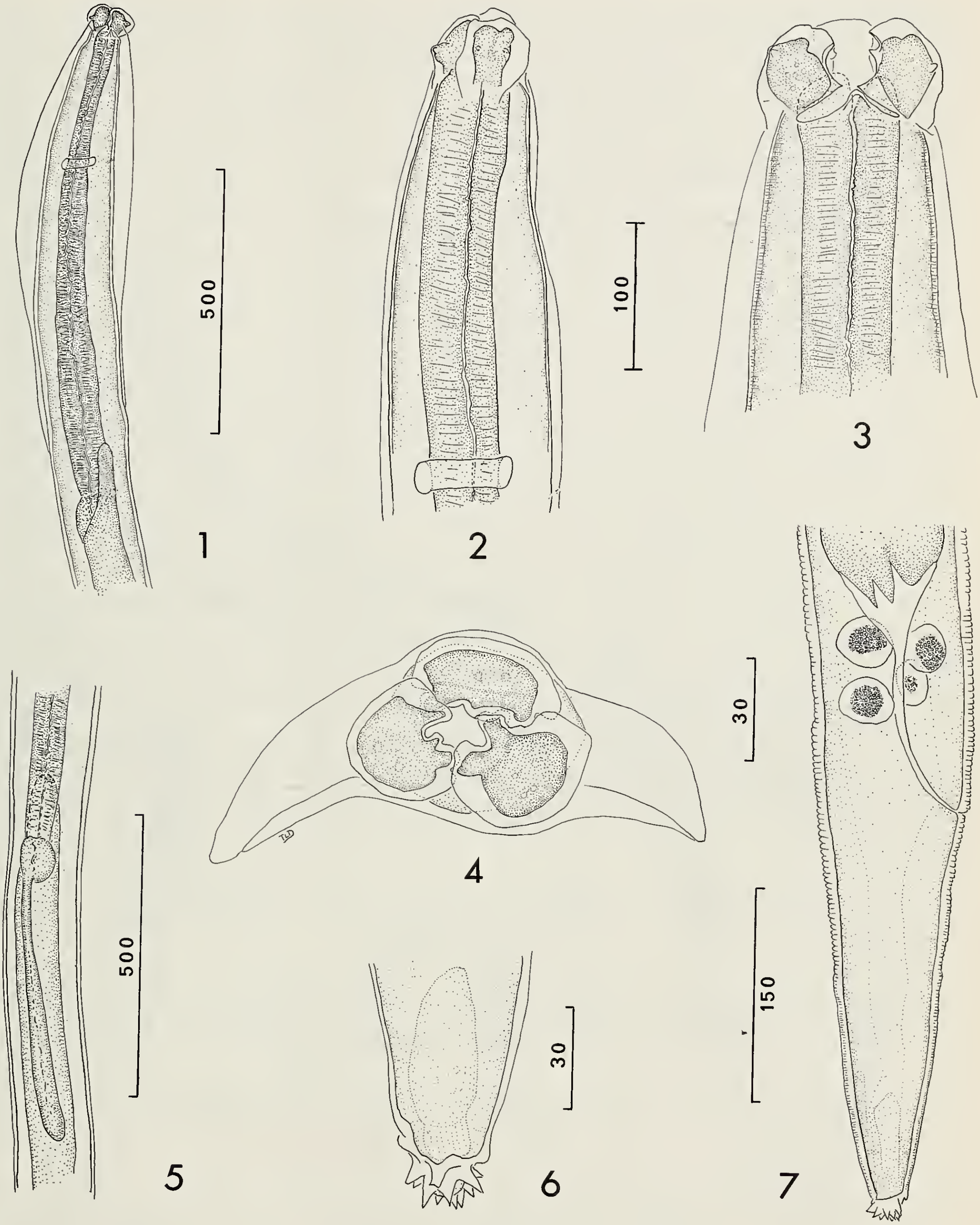
Localities.—Horn Island, Mississippi; Biscayne Bay, Florida; Ceará, Brazil (type-locality).

Specimens deposited.—USNM Helm. Coll. No. 75838 (pair); BMNH Reg. No. 1980.359–360 (pair); OCI 31.812a–b (pair).

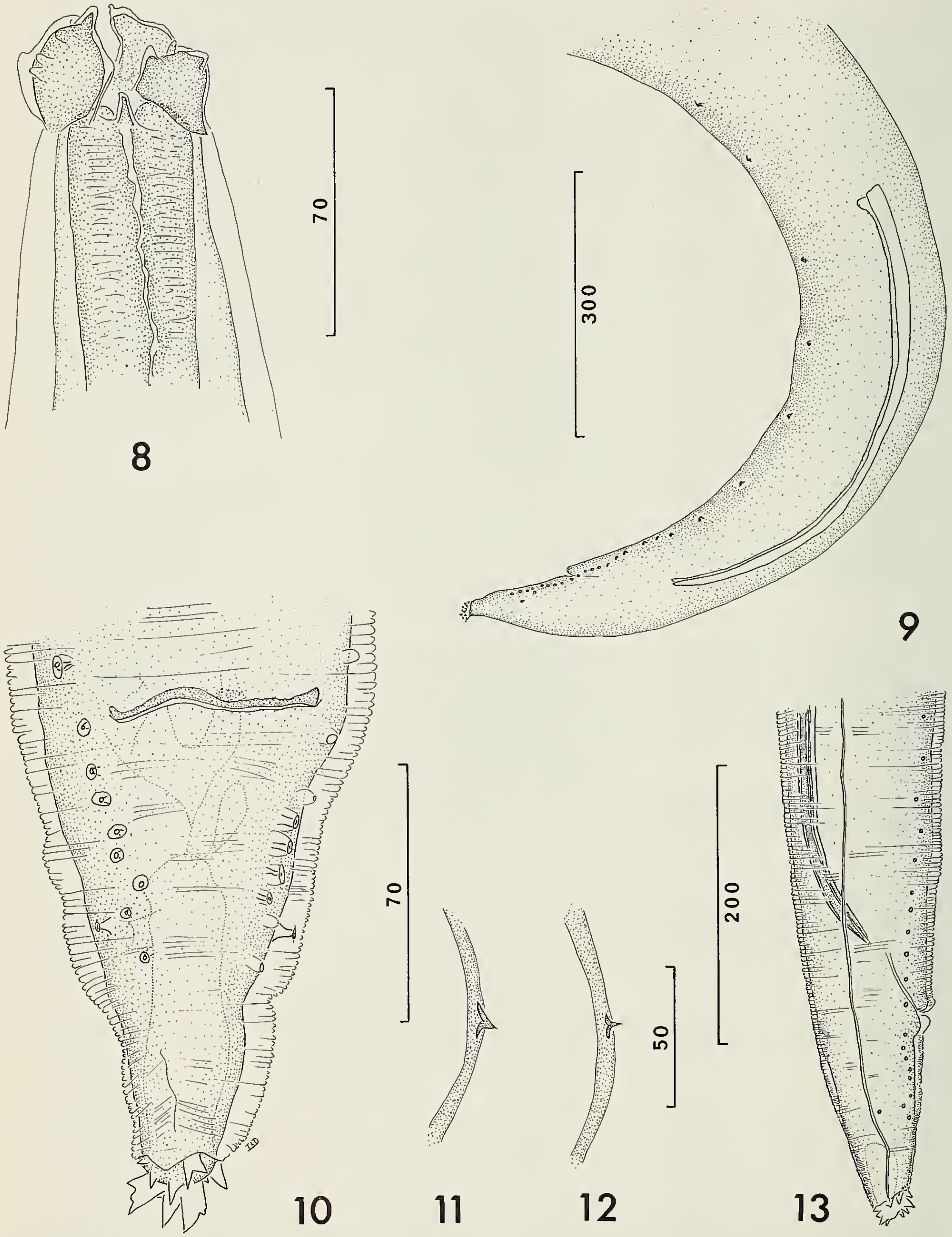
Remarks.—Klein (1973) collected *Hysterothylacium* (=*Contracaecum*) *fortalezae* at Ceará, Brazil, from the stomach and intestine of *Scombero-*

Table 3.—Larval ascaridoids of uncertain status, some of which probably will be shown as referable to *Hysterothylacium* and some probably will be junior synonyms.

Parasite	Remarks
Contracaecum aori Khan and Yaseen, 1969	In body cavity of *Mystus aor*; excretory pore not mentioned; intestinal cecum shorter than ventricular appendage; probably fourth stage larva.
Contracaecum benimasu Fujita, 1932	In body cavity of *Oncorhynchus* spp.; location of excretory pore not mentioned; vagina opening to rectum (?); probably fourth stage larva.
Contracaecum brevicaecum Khan and Yaseen, 1969	In body cavity of "sawfish"; excretory pore slightly posterior to level of nerve ring; third stage larva.
Contracaecum collieri Chandler, 1935	In body cavity of *Cyprinodon variegatus*; no excretory pore mentioned; intestinal cecum longer than ventricular appendage; third stage larva.
Contracaecum hippoglossi Fujita, 1932	In body cavity of several fishes; location of excretory pore not mentioned; intestinal cecum longer than ventricular appendage; vulva opens to rectum (?); probably developing fourth stage larva within third stage molt.
Contracaecum hypomesi Fujita, 1932	In body cavity of *Hypomesus* spp., *Clupea pallasi,* and *Oncorhynchus nerka* (as well as intestine); location of excretory pore not mentioned; intestinal cecum longer than ventricular appendage; probably fourth stage larva.
Contracaecum mesopi Fujita, 1940	In body cavity of *Mesopus olidus*; excretory pore near nerve ring; males unknown; probably fourth stage larva.
Contracaecum (*Thynnascaris*) *nototheniae* Johnston and Mawson, 1945	Immature specimens from *Notothenia rossi* and *N. macrocephala*; broad cervical alae of unequal length; location of excretory pore not mentioned; probably fourth stage larva.
Contracaecum oshoroensis Fujita, 1940	In body cavity of *Oncorhynchus keta* and *Mesopus olidus*; excretory pore "indistinct"; fourth stage larva.
Contracaecum taii Fujita, 1932	In body cavity of *Taius tumifrons*; excretory pore not mentioned; probably developing fourth stage larva.
Contracaecum (*Thynnascaris*) *tasmaniense* Johnston and Mawson, 1945	Site of infection not mentioned; from *Notopogon liliei* and *Coclorhynchus australis*; location of excretory pore not mentioned; intestinal cecum longer than ventricular appendage; fourth stage larva.
Contracaecum vittatii Khan and Begum, 1971	In body cavity of *Upeneus vittatus*; excretory pore near nerve ring; third stage larva.



Figs. 1–7. *Hysterothylacium fortalezae*: **1,** Anterior end showing lateral alae and spacial relationship between excretory pore and nerve ring; **2,** Dorsal view of lips; **3,** Ventral view of lips showing interlabium; **4,** *En face* showing lateral alae; **5,** Body at level of intestinal-ventricular junction, lateral view; **6,** Posterior extremity of female tail showing tuft of projections, lateral view; **7,** Female tail, lateral view.



Figs. 8–13. *Hysterothylacium fortalezae*: **8,** Ventral view of lips (paratype No. OCI 30.810c); **9,** Posterior end of male paratype showing caudal papillae, lateral view; **10,** Posterior end of male showing post- and para-anal papillae, ventral view; **11,** Lateral ala at esophageal-ventricular junction; **12,** Lateral ala immediately anterior to anus (scale same for Figs. 11, 12); **13,** Posterior end of male from Florida showing caudal papillae, lateral view.

morus cavalla and the type-host, *S. grasiliensis* (as *S. maculatus*) (Vicente, personal communication). Although most characteristics reported by Klein are comparable to those of our specimens collected from *S. maculatus* and *Oligoplites saurus* in the northern Gulf of Mexico and Biscayne Bay, Florida, discrepancies exist among her description, figures, and a paratype (OCI 30.810c) loaned by Vicente. She reported 21 pairs of caudal papillae made up of 5 preanal, 11 postanal, and 5 para-anal papillae. However, the paratype we examined, which was stained and permanently mounted on a slide, possessed 28 pairs of caudal papillae: 18 preanal, 8 postanal, and no para-anal (Fig. 9). Additionally, the cloacal opening was incorrectly located in the illustration, leading to difficulty assessing the papillae. Klein noted the prominent cervical alae, but did not include them in the *en face* illustration.

Hysterothylacium fortalezae and *H. chaunaxi* (Olsen, 1952) are distinguished from all other members of the genus in the Gulf of Mexico by having a tuft of projections at their posterior extremity rather than dense, evenly distributed spines on a conical tip; most of these projections were rounder on *H. chaunaxi.* What appears to be similar projections are illustrated for other species including specimens identified by Zhukov (1960) as *C. fabri* from *Scomber japonicus* (as *Pneumatophorus japonicus*), also a mackerel, from Putyatin Island, USSR. Those latter specimens and the status of *C. fabri* need further investigation. The conspicuous cervical alae on *H. fortalezae* separates it from *H. chaunaxi.* Those alae also occur on *H. aduncum* as shown by Punt (1941), *H. trichiuri,* and specimens identified as *H. clavatum* by Kreis (1952) and as *H. histiophori* by Olsen (1952). They may occur also on other species.

Hysterothylacium ogcocephali (Olsen), new combination

Figs. 14–21

Contracaecum ogcocephali Olsen, 1952:177–178, pl. I, figs. 12–17 (original description; type-host *Ogcocephalus radiatus*; type-locality Tortugas, Florida).

Thynnascaris ogcocephali.—Norris and Overstreet, 1975:333 (new combination).

Diagnosis.—Cuticle without conspicuous annulations; lips with ratio of length to width 1:0.5–0.7, with flanges indented at anterior ⅓ of lip; caudal papillar pairs: preanal 28–31, postanal 3–4 with 3rd or 4th papilla from posterior extremity doubled; spicules 1–2% of body length; spicule ratio 1:0.8–1.3; tail with short digitiform process lacking ornamentation on posterior extremity.

General.—Body reaching greatest width near midbody. Cuticle with inconspicuous annulations; lateral alae distinct on each side, becoming more apparent at levels posterior to rectum; supports nearly flat anteriorly and near midbody, with slight V-shape (in cross-section) in tail but not reaching external surface of cuticle. Lips approximately equal in size, 1.4–1.8 times longer than wide; flanges constricted at anterior ⅓ of lip; pulp narrowest at base, gradually becoming wider anteriorly. Interlabia with height equal to or slightly greater than width at base; interlabial grooves lacking. Esophagus 10–12% of body length. Ventriculus narrower than widest level of esophagus, nearly spherical; ventricular appendage descending without angulation from posterior portion of ventriculus. Nerve ring located at anterior 10–14% of esophagus. Excretory pore immediately posterior to level of nerve ring. Tail with short digitiform process; process lacking spines.

Male (based on 10 mature specimens for most characters and 5 tail mounts for postanal papillae): Body 25.5–33.5 mm long by 0.4–0.6 mm at greatest width; ratio of greatest width to length 1:49–60. Lips 180–236 long by 103–139 wide. Nerve ring 482–593 from anterior extremity, 24–41 in breadth. Esophagus 2.6–4.0 mm long by 166–216 wide. Ventriculus 108–166 long by 129–185 wide; ventricular appendage 0.9–1.5 mm long by 49–111 wide; ratio for lengths of ventricular appendage to esophagus 1:2.4–3.2. Intestinal cecum 185–309 long by 74–148 wide; ratio of cecal to ventricular appendage lengths 1:3.3–7.3; ratio of cecal to esophageal lengths 1:9.1–18.5. Spicules 1–2% of body length, unequal; left spicule 330–500 long by 19–28 wide; right spicule 350–660 long by 19–28 wide, longer than left spicule in 5 specimens; spicule ratio 1:0.8–1.3. Caudal papillae 31–34 pairs; preanal papillae pairs 28–31, with posteriormost one on right side doubled on one specimen; postanal pairs 3, except 4 papillae on right side and 3 on left of one specimen; with 3rd papilla from posterior extremity doubled except for one specimen on which left 2nd papilla doubled; para-anal papillae lacking. Medioventral preanal organ papillated, simple, at middle of preanal fold, single, directed posteriorly. Tail flexed ventrad, 139–185.

Female (based on 10 mature specimens): Body 25.6–48.1 mm long by 0.6–1.0 mm wide; ratio of greatest width to length 1:41–61. Lips 168–309 long by 130–166 wide. Nerve ring 552–704 from anterior extremity, 30–55 in breadth. Esophagus 3.1–5.3 mm long by 234–339 wide. Ventriculus 154–247 long by 185–241 wide; ventricular appendage 0.8–1.4 mm long by 74–123 wide; ratio for lengths of ventricular appendage to esophagus 1:2.8–4.7. Intestinal cecum 185–444 long by 123–247 wide; ratio of cecal to ventricular

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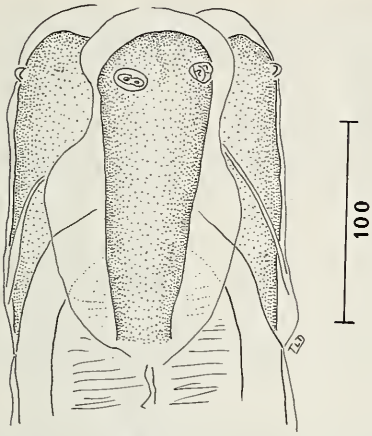
Figs. 14–21. *Hysterothylacium ogcocephali*: **14,** Dorsal view of lips; **15,** Ventral view of lips showing interlabium; **16,** *En face*; **17,** Body at level of intestinal-ventricular junction, lateral view; **18,** Posterior extremity of female tail, lateral view; **19,** Posterior end of female tail, lateral view; **20,** Posterior end of male showing caudal papillae, lateral view; **21,** Posterior end of male showing postanal papillae with atypical double second papilla on left side, ventral view.



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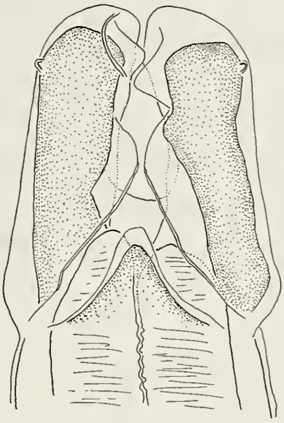

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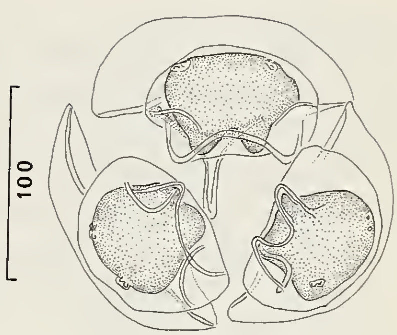

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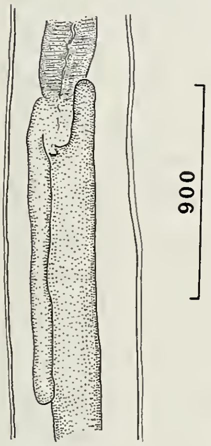

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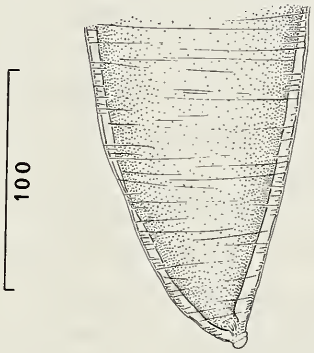

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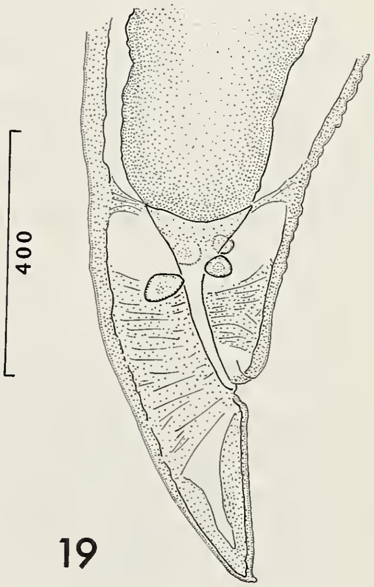

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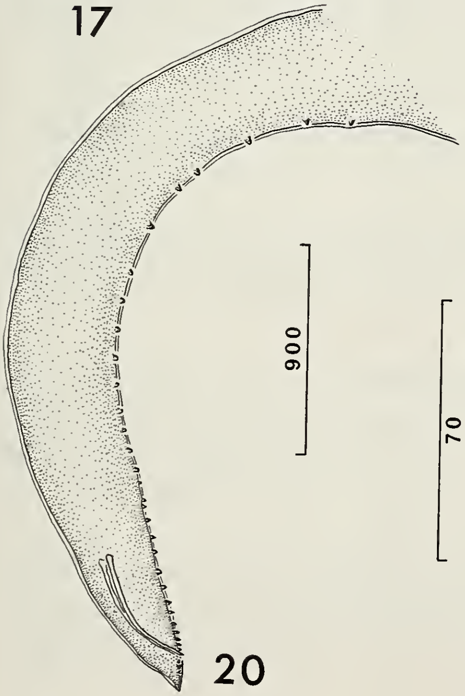

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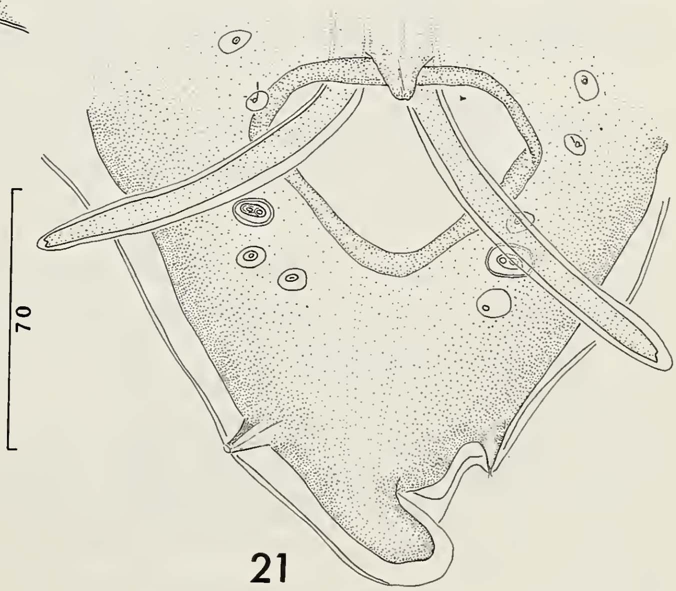

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appendage lengths 1:2.7–5.0; ratio of cecal to esophageal lengths 1:11–17. Vulva without salient lips, opening 9–13 mm or 24–40% of body length from anterior extremity. Ovaries rarely extending beyond anterior level of vulva. Eggs 30–55 in diameter. Tail 472–587 long including minute process.

Hosts.—*Ogcocephalus radiatus* (Mitchill), polka-dot batfish GCRL 7002, *O. cubifrons* (Richardson) (Ogcocephalidae).

Site of infection.—Stomach and upper intestine.

Localities.—Biscayne Bay, Tortugas, and Lee County (26°52′00″N, 82°18′35″W), Florida.

Specimens deposited.—USNM Helm. Coll. No. 75839 (pair); BMNH Reg. No. 1980.361–362 (pair); OCI 31.604.

Remarks.—Our report is the second for *H. ogcocephali.* Olsen (1952) originally described it from *Ogcocephalus radiatus* using data and figures from an unpublished thesis by B. Rees with most measurements given for one male and one female. Consequently, his description did not provide morphological variation among individuals. Additionally, Olsen did not treat some specific characters, and some differed from what we found. He reported 18–26 pairs of preanal papillae and 1–2 pairs of para-anal ones, whereas we counted a total of 31–34 pairs including the 3 postanal ones. We examined the holotype (USNM No. 37241) and confirmed that the lateral cephalic flanges had indentations near the anterior ⅓ similar to those for *Iheringascaris inquies.* The holotype's poor condition, however, resulted in many features being obscured. The terminal end of the tail lacked a multispinous structure (Fig. 21); a structure present on all species with similar lip morphology. This multispinous structure may prove to be a valuable diagnostic character in ascaridoid nematodes and should be noted when present.

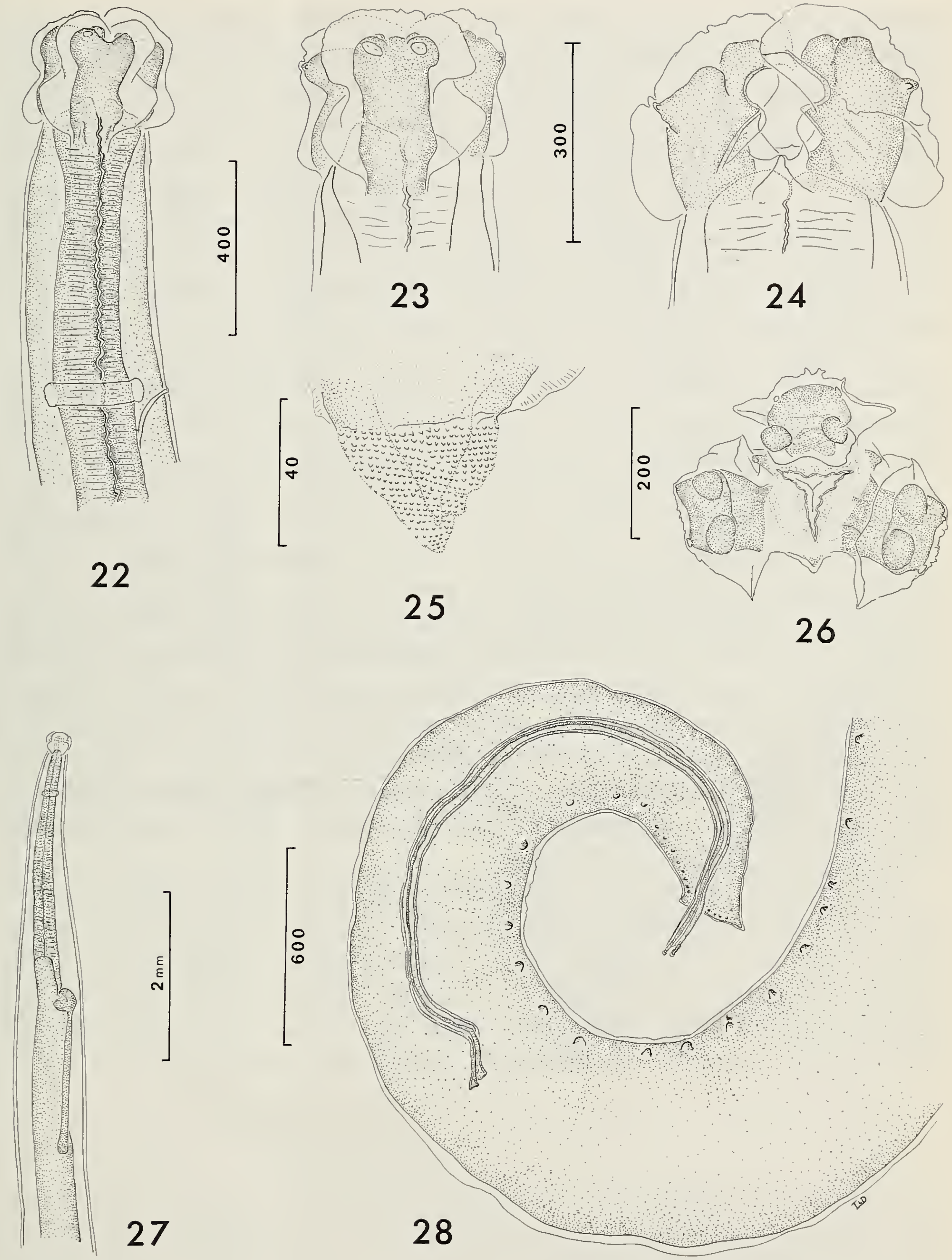
Hysterothylacium reliquens (Norris and Overstreet), new combination

Figs. 22–39

T. reliquens Norris and Overstreet, 1975:330–332, figs. 1–11 (original description; type-host *Archosargus probatocephalus*; type-locality Mississippi Sound, Mississippi).

Diagnosis.—Cuticle without conspicuous annulations; lips with ratio of length to width 1:0.6–1.0, with flanges indented equatorially; caudal papillar pairs: preanal 23–29, postanal 4–5 with 3rd pair from posterior extremity doubled; spicules 3–8% of body length; spicule-ratio 1:0.6–1.3; multispinous conical process on posterior extremity.

General (based on specimens from Ogcocephalus cubifrons).—Body reaching greatest width near midbody. Cuticle with inconspicuous annulations and minute lateral alae; alae becoming more apparent at levels posterior to rectum. Lips approximately equal in size, all longer than wide;



Figs. 22–28. *Hysterothylacium reliquens*: **22,** Anterior end showing spacial relationship between excretory pore and nerve ring; **23,** Dorsal view of lips; **24,** Ventral view of lips showing interlabium; **25,** Multispinous process on female tail, lateral view; **26,** *En face*; **27,** Body at level of intestinal-ventricular junction, lateral view; **28,** Posterior end of male showing caudal papillae, lateral view.

flanges constricted near middle of lip; pulp pedunculated. Interlabia with height equal to or slightly greater than width at base; interlabial grooves lacking. Esophagus 11–13% of body length. Ventriculus narrower than widest level of esophagus, usually longer than broad; ventricular appendage departing without angulation from posterior portion of ventriculus. Nerve ring located at anterior 16–28% of esophagus. Excretory pore at or immediately posterior to level of nerve ring; excretory system with duct extending posteromesial from pore toward esophagus before entering left lateral cord as lateral canal; lateral (=longitudinal) canal gradually increasing in diameter until termination within tail. Tail with spined conical mucronate extremity.

Male (based on 11 mature specimens, but 9 tail mounts for postanal papillae): Body 25–40 mm long by 0.5–0.9 mm at greatest width; ratio of greatest width to length 1:30–57. Lips 234–291 long by 234–285 wide. Nerve ring 646–977 from anterior extremity, 49–69 in breadth. Esophagus 3.3–4.5 mm long by 150–230 wide. Ventriculus 141–300 long by 110–236 wide; ventricular appendage 1.2–1.7 mm long by 80–130 wide; ratio for lengths of ventricular appendage to esophagus 1:2.5–2.8. Intestinal cecum 315–598 long by 260–310 wide; ratio of cecal to ventricular appendage lengths 1:2.2–3.5; ratio of cecal to esophageal lengths 1:7–10. Spicules 3–8% of body length, 1.7–2.4 mm long by 9–20 wide; right spicule longer than left one in 5, equal in 5, and shorter in 1 specimen; spicule-ratio 1:0.6–1.3. Caudal papillae 27–33 pairs, becoming closer together and more medial as approaching anus; preanal pairs 23–29; postanal pairs 4–5, with 3rd pair from posterior extremity doubled; para-anal papillae lacking. Medioventral preanal organ distinct, papillated. Tail flexed ventrad, 123–185 long including a multispinous process 12–46 long.

Female (based on 18 mature specimens): Body 21–44 mm long by 0.5–1.1 mm wide; ratio of greatest width to length 1:33–58. Lips 222–340 long by 204–309 wide. Nerve ring 646–977 from anterior extremity, 21–57 in breadth. Esophagus 2.9–5.0 mm long by 180–280 wide. Ventriculus 142–286 long by 126–331 wide; ventricular appendage 1.0–2.9 mm long by 95–140 wide; ratio for lengths of ventricular appendage to esophagus 1:1.7–3.0.

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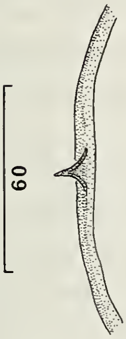
Figs. 29–39. *Hysterothylacium reliquens* from *Batrachoides surinamensis* (**29, 30, 31**), *Ogcocephalus cubifrons* (**33**), and *Archosargus probatocephalus* (**32, 34–39**). Lateral ala at anterior (**29**), middle (**30**), and posterior (**31**) parts of male. **32**, Lateral ala at level of base of esophagus equivalent to region in Fig. 29 (scale applies to all figures to its left); **33**, Posterior end of male showing postanal papillae, ventral view; **34**, Female tail, lateral view; **35**, Posterior end of male showing postanal papillae, ventral view; **36–39**, Cross-sections of excretory system showing excretory canal anterior to nerve ring (**36**), excretory pore (**37**), excretory duct (**37–38**), and excretory canal at esophageal-ventricular junction (**39**). Abbreviations: **ec** = excretory canal, **ed** = excretory duct, **ep** = excretory pore, **es** = esophagus, **lc** = lateral cord.



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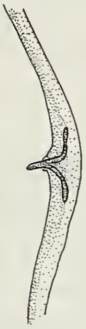

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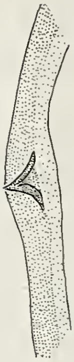

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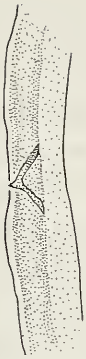

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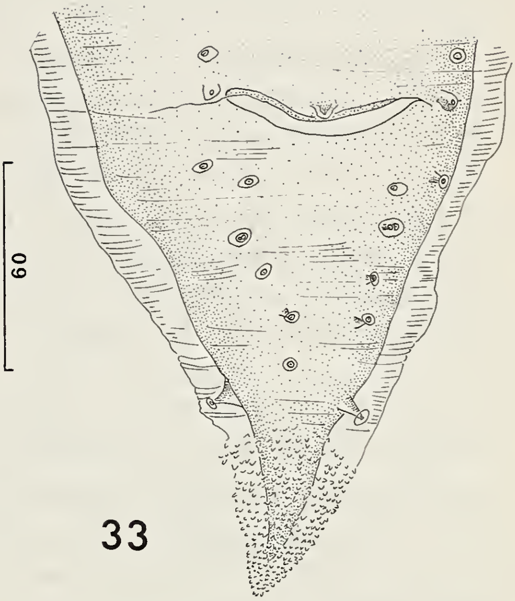

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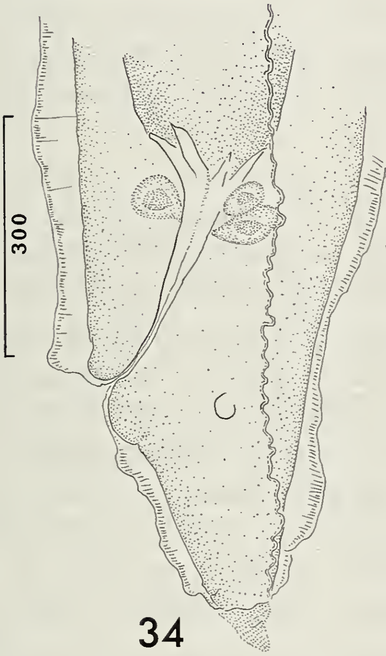

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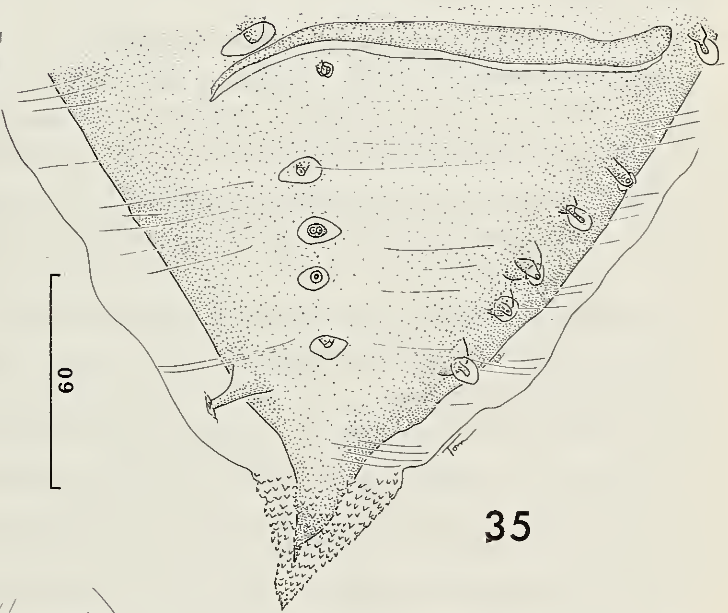

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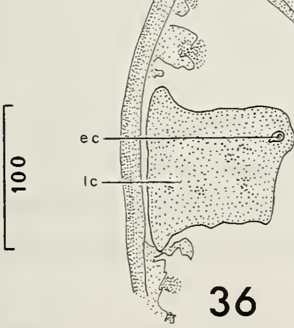

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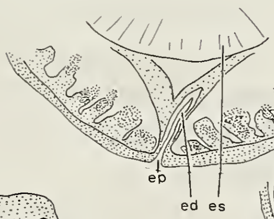

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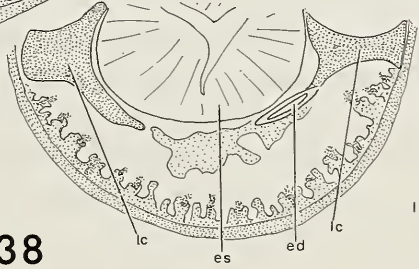

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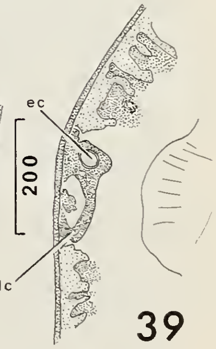

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Intestinal cecum 394–788 long by 265–322 wide; ratio of cecal to appendage lengths 1:1.6–5.2; ratio of cecal to esophageal lengths 1:5–8. Vulva without salient lips, opening 6.5–17.0 mm or 16–45% of body length from anterior extremity. Ovaries rarely extending beyond anterior level of vulva. Tail 370–574 long including multispinous process 12–60 long.

Hosts.—*Archosargus probatocephalus* (Walbaum), sheepshead (Sparidae) type-host; *Opsanus beta* (Goode and Bean), Gulf toadfish, *Batrachoides surinamensis* (Bloch and Schneider), *B. pacifici* (Günther), *B. boulengeri* Gilbert and Starks, and *Batrachoides* sp. (new species from El Salvador and the Pacific coast of Mexico being described by Collette and Russo, in press) (Batrachoididae); *Ogcocephalus cubifrons* (Richardson), *Ogcocephalus pantostictus* Bradbury, (GCRL 564) (Ogcocephalidae); *Arius felis* (Linnaeus), sea catfish (Ariidae); *Chilomycterus schoepfi* (Walbaum), striped burrfish (Diodontidae); *Micropogonias undulatus* (Linnaeus), Atlantic croaker, *Sciaenops ocellata* (Linnaeus), red drum (Sciaenidae); *Gymnothorax nigromarginatus* (Girard), blackedge moray (Muraenidae).

Sites of infection.—Stomach and intestine.

Localities.—Mississippi Sound, Mississippi (*Archosargus probatocephalus, Chilomycterus schoepfi,* and *Micropogonias undulatus*); offshore in northern Gulf of Mexico (*Sciaenops ocellata,* 30°10′N, 87°45′W, 11 meters; *M. undulatus* and *Gymnothorax nigromarginatus,* 29°33′N, 88°25′W, 46 meters; *C. schoepfi* and *A. probatocephalus,* 29°58′–59′N, 88°44′W, 15 meters; *Ogcocephalus* sp., offshore from Horn Island); Galveston, Texas (*Arius felis*); Biscayne Bay, Florida (*Opsanus beta*); Miami, Florida (*Ogcocephalus cubifrons*); Honduras, Guyana, and northern Brazil at 4°48′N, 51°19′W (*Batrachoides surinamensis,* TABL 104319, 104839, USNM 219457); Panamá (Miraflores Locks, San Francisco Beach, and 8°60′N, 79°31′W) and Colombia (*B. pacifici,* USNM 111862, 111865, UMML 26705, USNM 219385, *B. boulengeri,* GCRL 8402); and El Salvador (Bahia de Jiquilisco) and Mexico (Gulf of Tehuantepec) (*Batrachoides* sp. being described by Collette and Russo, in press, USNM 219788, SIO 63-517).

Specimens deposited.—from *Ogcocephalus cubifrons* (2 males and females) USNM Helm. Coll. No. 75840; from *Batrachoides surinamensis* (6 specimens) USNM Helm. Coll. No. 75498; from *Ogcocephalus pantostictus* (6 specimens) USNM Helm. Coll. No. 75841.

Remarks.—In addition to adding new host and locality records to those provided by Norris and Overstreet (1975), we present and discuss minor morphological variations among specimens from several hosts and provide descriptive data from specimens from a batfish for comparisons with descriptions of other species.

Worms from all hosts are similar, but we note minor differences in features such as postanal papillae. Norris and Overstreet (1975) reported 4–6 pairs of postanal papillae for *H. reliquens* from *Archosargus probatocephalus.* We examined 14 ventral tail mounts of the same and additional specimens from *A. probatocephalus* from Mississippi Sound and also counted 4–6 pairs; however, all but three males had uneven postanal papillar patterns. Six worms had 5 papillae on the right side and 4 on the left, and four worms had 6 on the right and 5 on the left. Additionally, the presence of doubled papillae was not originally noted. The fourth postanal papilla on the right side and third on the left from the posterior extremity of the worm exhibited this doubled condition. Of those worms with paired postanal papillae, one worm had 5 pairs with the fourth papilla doubled and two worms had 4 pairs with the third papilla doubled.

Papillae on three males from the sea catfish were like those from the batfish with 4 or 5 even pairs. Either the third or fourth pair from the worm's posterior end was doubled. However, the sclerotized supports of the lateral alae protruded beyond the cuticle, especially at the esophageal level.

Numerous worms were examined from several species of *Batrachoides* collected from Atlantic coasts of South America, the Panama Canal, and Colombia to Mexico in the Pacific Ocean. The papillae and alae extension (Figs. 29–31) agreed with those of catfish specimens indicated above. Specimens from *Opsanus beta,* also a batrachoidid, from Biscayne Bay, Florida, were the same, suggesting that the feature may be either host- or temperature-induced, since the worms in most other fishes as represented by the sheepshead, or type-host, in the northern Gulf of Mexico appeared to have indistinct alae by comparison (Fig. 32).

The presence of *H. reliquens* in the Pacific Ocean is unusual because few, if any, other ascaridoids in nonpelagic fishes occur in both the Atlantic and Pacific oceans. *Hysterothylacium aduncum,* considered a junior synonym of *H. gadi* by Hartwich (1975) and others, has been reported from the Pacific, but specimens reported from both oceans need critical examination.

Hysterothylacium reliquens heavily infects different hosts in different regions. As examples, heavy infections occurred in *Ogcocephalus cubifrons* from Miami, Florida, *Archosargus probatocephalus* from Mississippi, *Arius felis* from Galveston Bay, Texas, and *Batrachoides surinamensis* from northern Brazil. Collette and Russo (in press) revised the genus *Batrachoides* and examined a few intestines of each of the nine species, finding *H. reliquens* in four species. *Batrachoides manglae* Cervigón from hypersaline regions of Venezuela and *B. goldmani* Evermann and Goldsborough from freshwater streams in Mexico and Guatemala were two species that did not harbor *H. reliquens.* We speculate that fish acquire *H. reliquens* in relatively high-salinity regions or from intermediate hosts that recently inhabited such regions based on 1) infections in batrachoidids restricted to locations with salinities above 20 ppt but not hypersaline; 2) heavy infections in some fishes caught offshore or in high-salinity habitats; 3) large numbers of noninfected susceptible fishes in relatively low-salinity water of Mississippi Sound and elsewhere; and 4) findings in some infected fish from relatively low salinities of Mississippi Sound of additional concurrent helminths that depend on high-salinity habitats to complete their cycles. Infections also relate to food habits and perhaps to physiological races of worms. In any event, we neither encountered infected *A. felis* in Mississippi Sound nor encountered or heard about conspicuously infected sheepshead in Texas (including Galveston Bay) from numerous Texas sources. Specimens of *Chilomycterus schoepfi* and *Micropogonias undulatus* occasionally had infections in Mississippi Sound or near the barrier islands, but never heavy ones like in individual sheepshead which often harbored more than 350 worms, half of which were mature and many of which exited the host following removal of the fish from water. Other than the single Atlantic croaker (*M. undulatus*) listed from 46 meters deep off the Chandeleur Islands in 1973, we did not collect any other specimens of *H. reliquens* from offshore croaker. Between 1974 and 1977, we examined 1,700 croaker collected by the R/V OREGON II and GEORGE M. BOWERS from 42 stations with depths ranging from 11–90 meters and did not find *H. reliquens*.

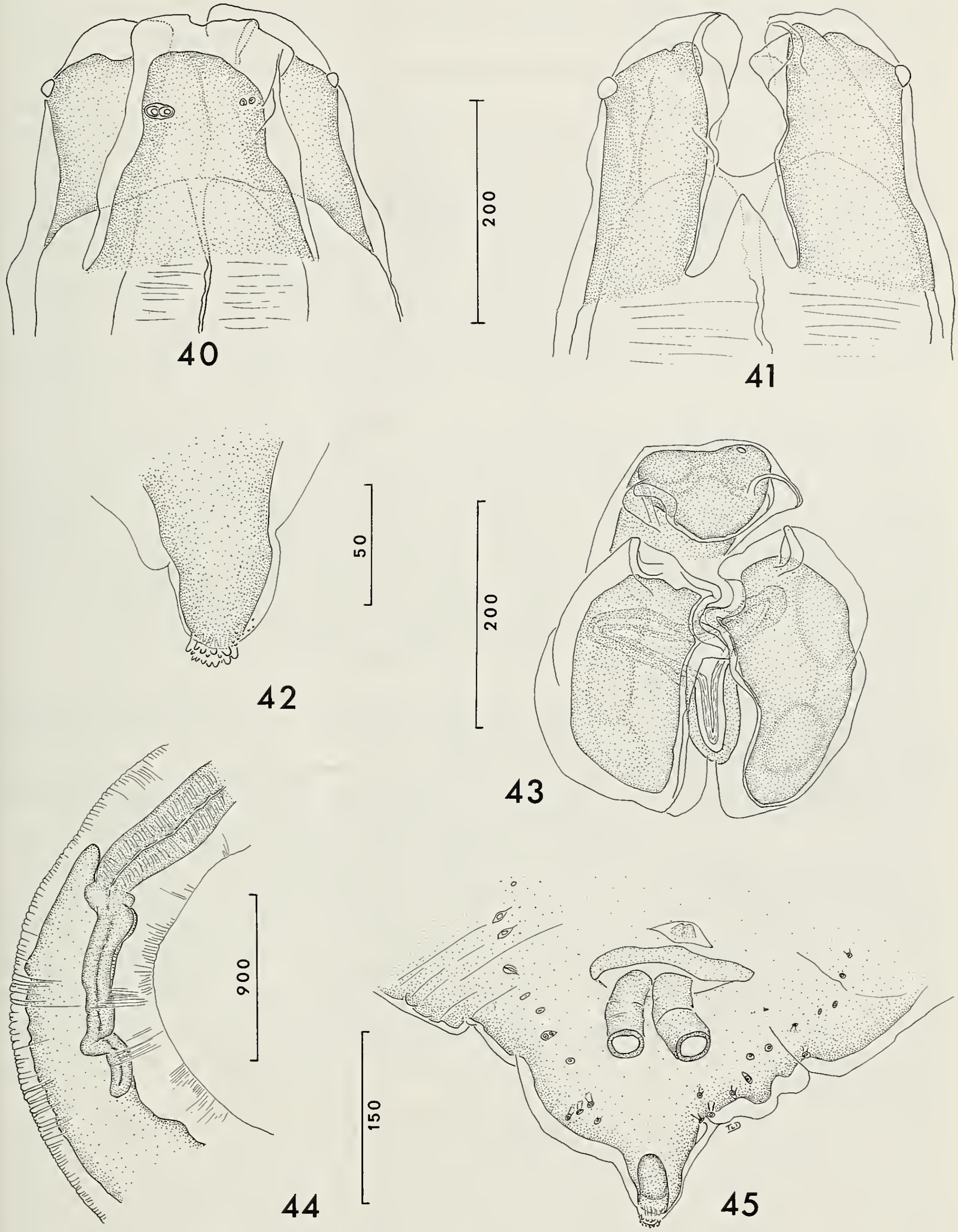
Four species of *Hysterothylacium, H. reliquens* and *H. ogcocephali* from the Gulf of Mexico, *H. melichthysi* from the Hawaiian Islands, and *H. rhacodes* from the eastern Mediterranean Sea, have the diagnostically elongated lips. The lips contain elongated pulp bordered by distinctly indented lateral flanges. Other species also have indented flanges, but not in conjunction with elongated lips. Flanges on *H. reliquens* are indented equatorially, whereas the position on those of *H. ogcocephali* and *H. melichthysi* occurs about ⅓ of the length from the anterior end. *Hysterothylacium rhacodes* has similar flanges to *H. reliquens,* but does not have any doubled postanal papillae.

Hysterothylacium chaunaxi (Olsen), new combination
Figs. 40–45

Contracaecum chaunaxi Olsen, 1952:178, pl. II, figs. 18–22 (original description; type-host *Chaunax* sp.; type-locality Tortugas, Florida).

Diagnosis.—Cuticle without conspicuous annulations; lips with ratio of length to width 1:0.8, with pulp not pedunculate; caudal papillar pairs: preanal 23, postanal 7 with doubled papilla 6th from posterior extremity on right side; tuft of projections at posterior extremity.

General.—Body reaching greatest width near midbody. Cuticle with inconspicuous annulations. Lips approximately equal in size; pulp not pedunculate, widest at base. Interlabia with width at base equal to or slightly greater than height; interlabial grooves lacking. Ventriculus narrower than widest level of esophagus, usually longer than wide; ventricular appendage



Figs. 40–45. *Hysterothylacium chaunaxi*: **40,** Dorsal view of lips; **41,** Ventral view of lips showing interlabium; **42,** Posterior extremity of female tail showing terminal tuft with projections, lateral view; **43,** *En face*; **44,** Body at level of intestinal-ventricular junction, lateral view; **45,** Posterior end of male showing postanal papillae, ventral view; note broken spicules.

descending without angulation from posterior portion of ventriculus. Excretory pore just posterior to level of nerve ring. Tail with tuft of rounded and pointed projections at posterior extremity.

Male (based on 1 specimen plus holotype USNM Helm. Coll. No. 37243 with its measurements in parentheses): Body 34.7 (39.5) mm long by 947 (709) at greatest width; ratio of greatest width to length 1:36 (1:56). Lips 253 (120) long. Esophagus 2.8 (3.3) mm long by 333 wide or 8 (8)% of body length. Ventriculus 284 (259) long by 174 (279) wide; ventricular appendage 1.2 mm long (not visible) by 173 wide; ratio for lengths of ventricular appendage to esophagus 1:2.3. Intestinal cecum 819 (1.0 mm) long by 488 (247) wide; ratio of cecal to ventricular appendage lengths 1:1.4; ratio of cecal to esophagus lengths 1:3.4 (1:3.3). Nerve ring located within anterior 26% of esophagus, 50 in breadth. Excretory pore immediately below posterior level of nerve ring. Spicules broken at cloaca, 1.5 mm long by 31 wide. Caudal papillae 30 pairs (not able to count), becoming closer together and more medial as approaching anus; preanal pairs 23; postanal pairs 7, doubled papilla 5th from posterior extremity on right side only; para-anal papillae lacking. Medioventral preanal organ distinct, papillated. Tail 185 (203) long including tuft with projections up to 12 long on posterior extremity.

Host.—*Chaunax pictus* Lowe (Chaunacidae) GCRL 679.

Site of infection.—Intestine.

Localities.—Tortugas, Florida (type-locality) and 29°13′N, 87°55.5′W (460 meters) R/V OREGON Station No. 3680.

Specimen deposited.—USNM Helm. Coll. No. 75842, body-fragments in vial plus *en face* and tail mounted in glycerin jelly on separate slides.

Remarks.—Olsen (1952) noted the tuft on the tail of *H. chaunaxi,* although he did not illustrate it. On the basis of this distinct structure at the posterior extremity (Figs. 42, 45), *H. chaunaxi* and *H. fortalezae* differ from all other examined members of the genus. *Hysterothylacium chaunaxi* can be distinguished from *H. fortalezae* by body length, ratio of greatest width to length, ratio of cecal to ventricular appendage lengths, and number and arrangement of pre- and postanal papillae. Additionally, *H. chaunaxi* lacks conspicuous anterior cervical alae.

One of five, fixed, museum specimens of *Chaunax pictus* collected from the same locality in the Gulf of Mexico harbored the single male *H. chaunaxi*. Olsen described *H. chaunaxi* from *Chaunax* sp. at Tortugas, Florida, also from a single male. The holotype is rather opaque; consequently, we do not include data on all its features above. The type-host is presumably *C. pictus*. No other records of an infection exist.

Hysterothylacium incurvum (Rudolphi), new combination

Figs. 46–56

Ascaris incurva Rudolphi, 1819:51, 292–293 (original description; type-host *Xiphias gladius*; type-locality Baltic Sea).

Contracaecum incurvum.—Baylis and Daubney, 1922:282–284, figs. 17–18 (new combination).
Contracaecum (*Thynnascaris*) *incurvum.*—Dollfus, 1935:89–90 (new combination).
Thynnascaris incurva.—Hartwich, 1957:240 (new combination).

Diagnosis.—Cuticle with enlarged and modified annules on ventral surface of male near cloaca; alae bifurcated at tips; lips with ratio of length to width 1:1.0–1.6, with pulp deeply constricted at base, with interlabial grooves deep; caudal papillar pairs: preanal 27–28, postanal 4, para-anal 1, doubled; spicules 12–25% of body length; spicule-ratio 1:0.9–1.0; tail gradually tapering, lacking ornamentation on posterior extremity (note exception below).

General (based on specimens from Florida).—Body reaching greatest width near midbody. Cuticle with inconspicuous annulations except those enlarged and modified on ventral surface of male near cloaca. Lateral alae bifurcate at tips throughout worm; supports in cross-section nearly meeting before diverging, typically external to cuticle; cervical alae not flaring. Lips approximately equal in size, all broader than long; flanges widest near base, indented at anterior ⅓ of lip. Pulp conspicuously narrow near base. Interlabia with height 2 times greater than width at base, with rounded tips; interlabial grooves deep; adjacent grooves nearly merging at base of each lip. Esophagus clavate, 7–16% of body length. Ventriculus narrower than widest level of esophagus, generally longer than broad. Nerve ring located between anterior 7–19% of esophagus. Excretory pore immediately posterior to level of nerve ring. Tail gradually tapering.

Male (based on 11 mature specimens): Body 17–34 mm long by 606–772 at greatest width; ratio of greatest width to length 1:29–49. Lips 86–154 long by 108–212 wide. Nerve ring 376–593 from anterior extremity, 33–55 in breadth. Esophagus 2.3–5.2 mm long by 92–166 wide. Ventriculus 117–166 long by 129–216 wide; ventricular appendage 1.7–2.6 mm long by 61–195 wide; ratio for lengths of ventricular appendage to esophagus 1:1–3. Intestinal cecum 1.9–4.5 mm long by 166–233 wide; ratio of lengths of cecum to ventricular appendage 1:0.4–1.0; ratio for lengths of cecal to esophageal length 1:1.0–1.5. Spicules 12–25% of body length, 2.6–8.7 mm long by 9–18 wide, equal in 8 specimens; left spicule longer in 2 specimens; spicule-ratio 1:0.9–1.0. Caudal papillae 31–32 pairs, becoming closer and more medial as approaching anus; preanal pairs 27–28; postanal pairs 4; para-anal papilla 1, doubled. Medioventral preanal organ distinct, papillated. Tail flexed ventrad, 79–197 long, without ornamentation. Modified annules on ventral surface beginning near anus, extending anteriorly 2.0–6.1 mm or 10–18% of body length; each annule with 45–57 minute longitudinal supports; supports similar, lamellar, semicircular, 8–17 apart.

Female (based on 21 mature specimens): Body 25–69 mm long by 0.5–1.7

mm wide; ratio of greatest width to length 1:28–61. Lips 110–214 long by 132–222 wide. Nerve ring 414–646 from anterior extremity, 26–48 in breadth. Esophagus clavate, 2.6–7.2 mm long by 100–278 wide. Ventriculus 173–362 by 210–551; ventricular appendage 0.6–4.0 mm long by 0.2–1.1 mm wide; ratio for lengths of ventricular appendage to esophagus 1:1.5–4.5. Intestinal cecum 1.5–5.1 mm long by 80–488 wide; ratio of lengths of cecum to ventricular appendage 1:0.3–18.0; ratio of cecal to esophageal lengths 1:1.0–2.0. Vulva opening 7.3–35.1 mm or 25–40% of body length from anterior extremity, not protruding. Ovaries rarely extending anteriad beyond level of vulva. Eggs 18–63 in diameter. Tail 677–945 long, with tip usually without spines but single spine on one worm.

Hosts.—*Xiphias gladius* (Linnaeus), swordfish (Xiphiidae) type-host; *Tetrapturus albidus* (Poey), white marlin; *T. brevirostris* (Playfair), striped marlin (from Tanzania) (Istiophoridae).

Site of infection.—Stomach.

Localities.—Offshore from Destin (*T. albidus*) and Miami (*X. gladius*), Florida; Baltic Sea; off India; near Zanzibar, Tanzania.

Specimens deposited.—From *T. albidus* (2 pairs) USNM Helm. Coll. No. 75843; (pair) BMNH Reg. No. 1980.363–364; (pair) ZM No. 7053.

Remarks.—We examined six male and six female syntypes of *H. incurvum* (ZM No. 468) deposited by Rudolphi in October 1818, and, even though their condition was poor, we determined the presence of diagnostic deep interlabial grooves and modified ventral annules on the males. They lacked prominent cervical alae. Because of their condition and because we did not see all the syntypes, we refrain from establishing a lectotype, but nevertheless consider the specimens conspecific with our material, some of which came from the type-host. With the permission of G. Hartwich, who counted the same number and kind of postanal papillae on two syntypes that we did (personal communication), we deposited a female and the tail and two anterior fragments of male syntypes in the U.S. National Museum (USNM Helm. Coll. No. 75151).

In our material the vulva did not protrude as reported by Berland (1961), suggesting that such a feature results from a shrinkage or fixation artifact as Berland proposed.

We also examined a male specimen (BMNH No. 1923.1.22.3) from a swordfish caught off India and identified by Baylis and Daubney (1922) as *Contracaecum incurvum* and 21 females and 5 males (BMNH No. 1962.40–47) from *Tetrapturus brevirostris* (as *Makaira audax*) caught near Zanzibar.

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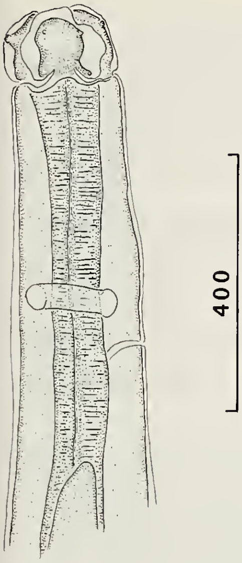
Figs. 46–52. *Hysterothylacium incurvum*: **46,** Anterior end showing spacial relationship between excretory pore and nerve ring, lateral view; **47,** Dorsal view of lips; **48,** Ventral view of lips showing interlabium; **49,** *En face*; **50,** Posterior end of male showing both caudal papillae and annules on ventral surface, lateral view; **51,** Posterior end of male showing postanal papillae, lateral view; **52,** Posterior end of male showing postanal papillae, ventral view.



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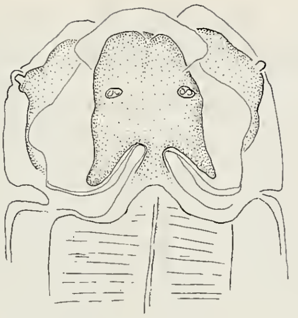

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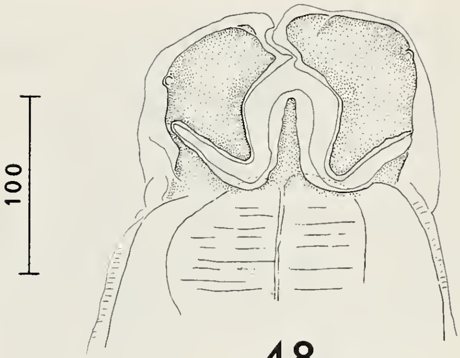

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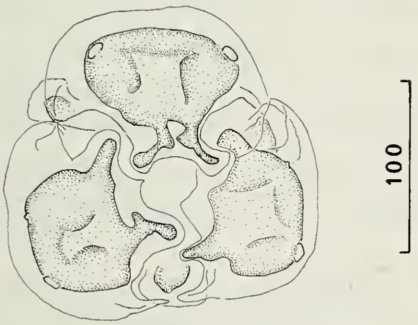

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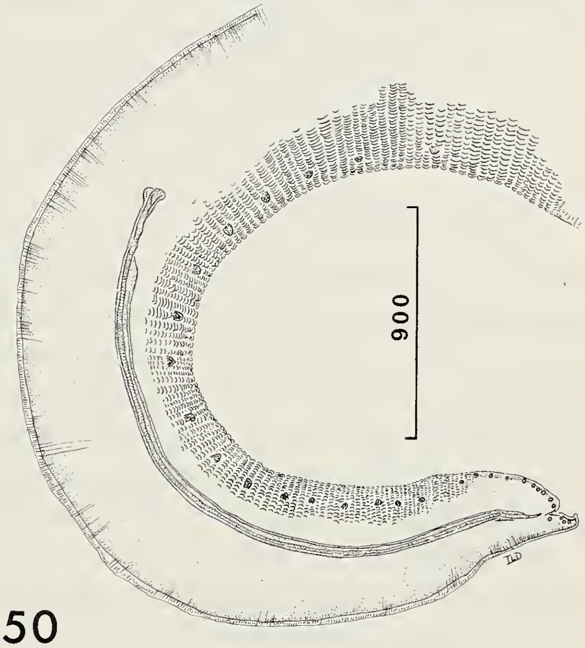

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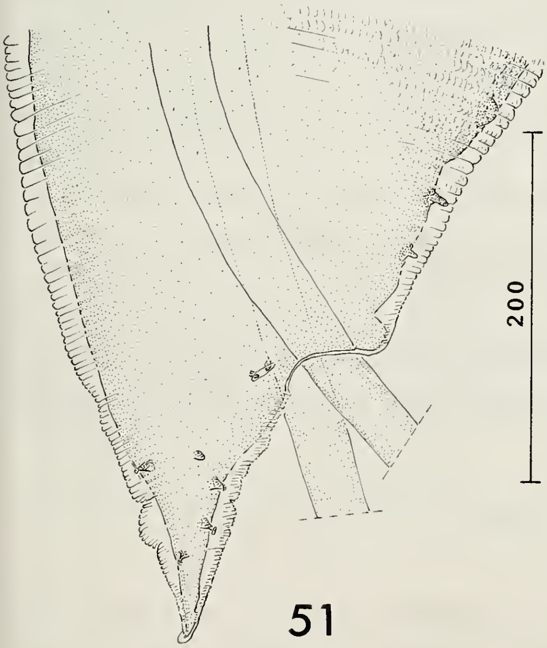

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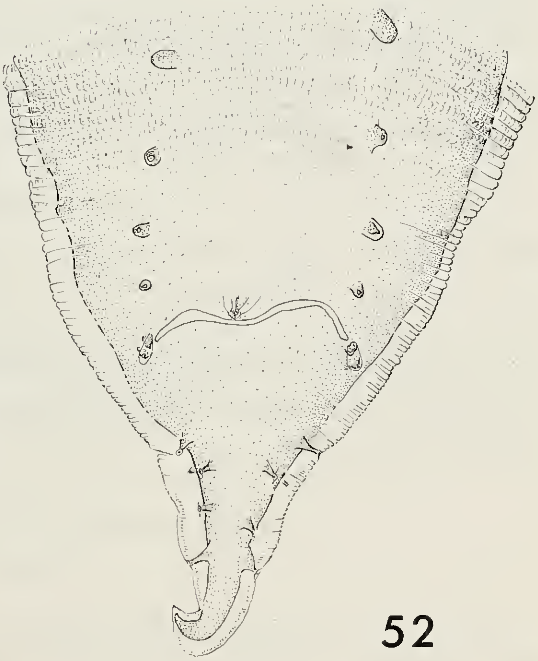

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All appeared to be *H. incurvum.* In fact, the species probably occurs throughout the range of swordfishes. Unconfirmed reports of *C. incurvum* indicate the worm's abundance in white marlin off Ocean City, Maryland (Wallace and Wallace, 1942) and the southern Gulf of Mexico (Nikolaeva and Parukhin, 1968) and in *T. audax* (as *Makaira mitsukurii* Jordan and Snyder) from Brett Cape to the Cavalli Islands, New Zealand (Morrow, 1952). Hosts other than swordfish such as the sailfish (as *Histiophorus gladius*), the Spanish mackerel, and the sand-bar shark, *Carcharhinus plumbeus* (Nardo) (as *Carcharias cerulcus*) have been reported as hosts of mature specimens (e.g., Linton, 1901; Walton, 1927; Nikolaeva and Parukhin, 1968), but such identifications also require confirmation.

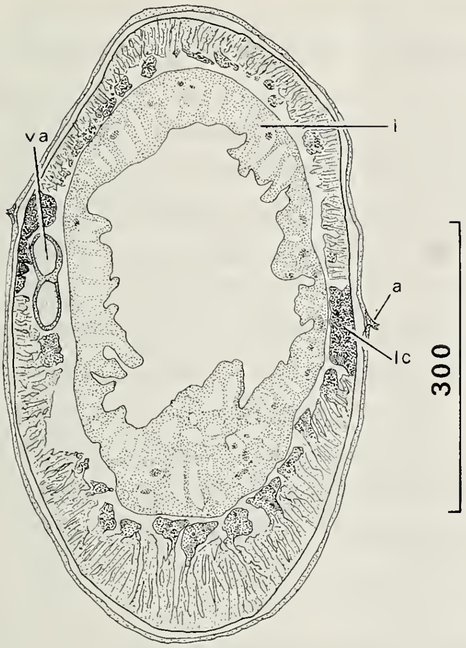
Nikolaeva and Parukhin (1968) reported a maximum of 1,787 specimens from a single white marlin. We never encountered such heavy infections, but numerous individuals often exited from the mouth and opercula of dead fish to the disgust of fishermen.

Only two species of *Hysterothylacium* have been reported from swordfishes and billfishes: *H. incurvum* and *H. histiophori.* Rudolphi (1819) originally described *Ascaris incurva* from the swordfish, *Xiphias gladius* Linnaeus, in the Baltic Sea, a rather rare locality for the host (A. Wheeler, personal communication). Yamaguti (1935) described *C. histiophori* from the sailfish *Istiophorus platypterus* (Shaw and Nodder) (as *Histiophorus orientalis*) in Toyama Bay, Japan. Neither Rudolphi nor Yamaguti provided many diagnostic features in their descriptions.

The status of *H. histiophori* has not been adequately ascertained. Yamaguti (1935), who based the description on one mature female and an immature pair, differentiated it from *H. incurvum,* which he reported from *Xiphias gladius* in the same paper, on the basis of body length and positions of both the nerve ring and vulva. We have been unable to locate type specimens of *H. histiophori* or any other specimens from the same host from the Meguro Parasitological Museum (Atsuo Ichihara, personal communication) or elsewhere. Olsen (1952) reported *C. histiophori* from the sailfish *I. platypterus* (as *I. americanus*) caught off the "Florida coast." We do not know whether these specimens (6 mature and 3 immature males, plus 3 mature and 14 immature females), not deposited in the U.S. National Museum, represent *H. histiophori* or a new species. In any event, even though it has deep interlabial grooves and modified ventral annules in the male, we consider its prominent cervical alae sufficient to differentiate the species from *H. incurvum.*

Hysterothylacium corrugatum, new species
Figs. 57–63

Diagnosis.—Cuticle with enlarged and modified annules on ventral surface of male near cloaca; lips with ratio of length to width 1:1.0–1.3, with



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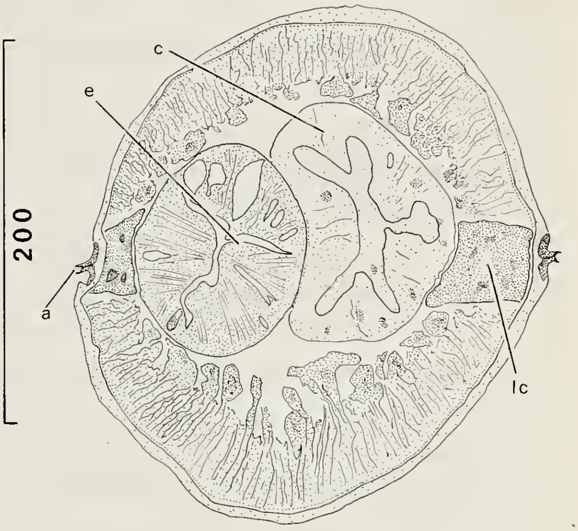

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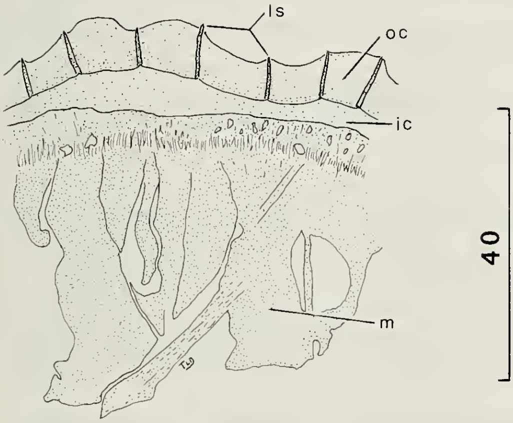

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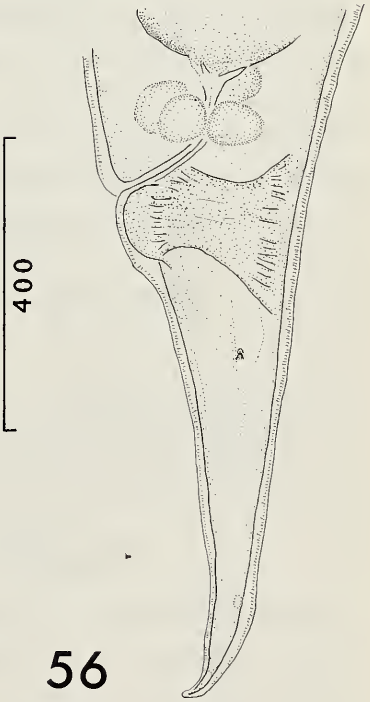

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Figs. 53–56. *Hysterothylacium incurvum*: **53,** Cross-section of worm through level of ventricular appendage; **54,** Cross-section of worm showing intestinal cecum; **55,** Cross-section through modified annules on ventral surface of males; **56,** Posterior end of female tail, lateral view. Abbreviations: **a** = lateral alae, **c** = intestinal cecum, **e** = esophagus, **i** = intestine, **ic** = inner cuticular layer, **lc** = lateral cord, **ls** = longitudinal supports, **m** = muscle, **oc** = outer cuticular layer, and **va** = ventricular appendage.

interlabial grooves lacking; caudal papillar pairs: preanal 24–26, postanal 4, para-anal 1, doubled; spicules 4–7% of body length; spicule-ratio 1:1.0; tail gradually tapering, terminating without ornamentation.

General (based on specimens from Florida).—Body reaching greatest width near midbody. Cuticle with inconspicuous annulations except ventrally on male's posterior. Cervical alae not flaring. Lips approximately equal in size, occasionally broader than long; flanges widest near base, indented at anterior $^2/_5$. Pulp for each lip not narrowed at base, each with 2–4 lobular projections often a few times longer than wide. Interlabia with height equal to or slightly less than width at base, with rounded tips; interlabial grooves lacking. Esophagus clavate, 5–13% of body length. Ventriculus narrower than widest level of esophagus, generally longer than broad; ventricular appendage descending without angulation from posterior portion of ventriculus. Nerve ring located between anterior 6–12% of esophagus. Excretory pore immediately posterior to level of nerve ring. Tail gradually tapering, terminating without ornamentation.

Male (based on 5 mature specimens): Body 26–50 mm long by 0.4–1.0 mm at greatest width; ratio of greatest width to length 1:49–69. Lips 96–145 long by 89–168 wide. Nerve ring 284–593 from anterior extremity, 30–48 in breadth. Esophagus 3.0–5.6 mm long by 60–191 wide. Ventriculus 36–154 long by 57–185 wide; ventricular appendage 2.4–3.8 mm long by 43–60 wide; ratio for lengths of ventricular appendage to esophagus 1:1.0–2.3. Intestinal cecum 2.3–4.6 mm long by 48–204 wide; ratio of cecal to ventricular appendage lengths 1:0.6–0.9; ratio of cecal to esophageal lengths 1:1.0–1.3. Spicules 4–7% of body length, similar; left spicule 1.2–2.5 mm long by 12–18 wide; right spicule 1.2–2.6 mm long by 12–18 wide; spicule-ratio 1:1.0. Caudal papillae 29–31 pairs, becoming closer together and more medial as approaching anus; preanal pairs 24–26; postanal pairs 4; para-anal pair 1, doubled. Medioventral preanal organ distinct, papillated. Tail flexed ventrad, 191–245 long. Modified annules on ventral surface, beginning near anus, extending anteriorly 1.0–4.1 mm or 3–15% of body length.

Female (based on 6 mature specimens): Body 100–142 mm long by 1.7–2.6 mm wide; ratio of greatest width to length 1:40–75. Lips 203–259 long by 210–247 wide. Nerve ring 709–756 from anterior extremity, 43–61 in breadth. Esophagus clavate, 5.5–8.5 mm long by 283–315 wide. Ventriculus 154–472 by 220–283; ventricular appendage 3.5–4.3 mm long by 80–98 wide; ratio of ventricular appendage to esophagus lengths 1:1.5–2.0. Intestinal cecum 5.3–7.2 mm long by 346–583 wide; ratio of lengths of cecum to ventricular appendage 1:0.6–0.7; ratio of cecal to esophagus lengths 1:1.0–1.2. Vulva opening 35–40 mm or 33–39% of body length from anterior extremity. Ovaries rarely extending anteriad beyond level of vulva. Eggs 40–80 in diameter. Tail 0.8–1.1 long.

Host.—Xiphias gladius (Linnaeus), swordfish (Xiphiidae).

Site of infection.—Stomach.

Localities.—Offshore from Miami (type-locality); Panama City, Florida; and Manta, Ecuador.

Specimens deposited.—Holotype, male, USNM Helm. Coll. No. 75844; Allotype, female, No. 75845; Paratypes, No. 75846 (pair), British Museum (Natural History) Reg. No. 1980.365–366 (pair); Additional specimens, ZM No. 7054 (female and anterior of male).

Etymology.—The Latin *corrugatum* means "ridged," referring to the modified annules on the ventral surface of the males.

Remarks.—We examined three mature specimens, a male and two females (USNM Helm. Coll. No. 60051), from the swordfish caught at Manta, Ecuador, which were identified by M. Chitwood as *Contracaecum incurvum*. They lacked interlabial grooves, the male had 30 preanal papillae, and we consider them *H. corrugatum*.

Of the more than 300 nematodes from 22 specimens of white marlin caught offshore from Destin, Florida, to Orange Beach, Alabama, and the 85 from 4 specimens of the swordfish caught offshore from Miami and Panama City, Florida, only *H. incurvum* infected the white marlin, but both *H. incurvum* and *H. corrugatum* occurred in the swordfish.

By possessing modified annules on the ventral surface of the male, *H. corrugatum* most closely resembles *H. incurvum* and *H. histiophori* of Olsen (1952), but differs conspicuously by lacking deep interlabial grooves.

Hysterothylacium habena (Linton), new combination
Figs. 64–67

Ascaris habena Linton, 1900:302–303, figs. 109–115 (original description; type-host *Opsanus tau*; type-locality Woods Hole, Massachusetts).

Contracaecum habena.—Linton, 1934:125 (distribution and prevalence records; new combination).

Thynnascaris habena.—Hartwich, 1957 (new combination).

Diagnosis.—Cuticle with inconspicuous annulations; lips approximately as wide as long, narrowest at base, with ratio of greatest length to width 1:0.9–1.1, with labial flanges appearing as broad triangular projections slightly indented at anterior ¼ of lip; pulp pedunculate; caudal papillar pairs: preanal 21–31; postanal 3–4, with 3rd pair from posterior extremity doubled; process on posterior extremity conical, multispinous.

Remarks.—Since Linton's (1900) original description of *H. habena* from the oyster toadfish, *Opsanus tau* (Linnaeus), from Massachusetts, it has been redescribed by Chandler (1943) and by Norris and Overstreet (1975). We reexamined 2 males and 1 female from *O. tau* collected at Gloucester Point, Virginia, reported by Norris and Overstreet and supplement that description below. A pair of prominent phasmids occurred laterally on the spined distal process and three pairs of postanal papillae occurred on one specimen and four on the other. In both cases, the third pair from the posterior extremity was doubled. Designating papillae as para-anal is subjective for many species, including *H. habena*. Even though two pairs of papillae occur lateral to the lip anterior to the anus of *H. habena,* these appear as a continuum of preanal papillae as evident in ventral view (Fig. 64) rather than being clearly set-off and could therefore be considered preanal papillae. Ventral tail mounts are especially helpful in determining papillar patterns.

Hysterothylacium habena probably does not occur in the northern Gulf of Mexico as assumed by Hutton *et al.* (1962) and others. Their assumption was based on the presence of a larval species of *Hysterothylacium* (=*Contracaecum*) in penaeid shrimps from North Carolina to Central America and the Caribbean (actually at least three species infect these shrimps, Norris and Overstreet, 1976, personal observations) which have a ratio for the lengths of intestinal cecum to ventricular appendage similar to that for *H. habena*. *Hysterothylacium habena* extends from at least Massachusetts to Georgia in a batrachoidid from high-salinity habitats. We have not seen it among abundant ascaridoid material from batrachoidids collected in Florida, the northern Gulf of Mexico, and Central and South America.

Iheringascaris Pereira

Iheringascaris Pereira, 1935 (type-species *I. iheringascaris* Pereira, 1935, junior synonym of *I. inquies*).

Diagnosis.—Body relatively narrow. Cuticle with distinctly plicated annulations lacking spines. Cuticular alae present. Lips approximately equal in size, bearing transparent cuticular flanges on lateral margins; dorsal lip with two lateral doubled papillae; subventral lips with amphid, adjacent mediolateral doubled papilla, and single lateral papilla. Dentigerous ridges absent. Interlabia present, without deep interlabial grooves. Ventriculus nearly spherical; ventricular appendage cylindrical with septum dividing structure into 2 equal longitudinal pouches; intestinal cecum shorter than ventricular appendage. Excretory system with duct off central commissure opening as pore near level of nerve ring, with excretory canals extending

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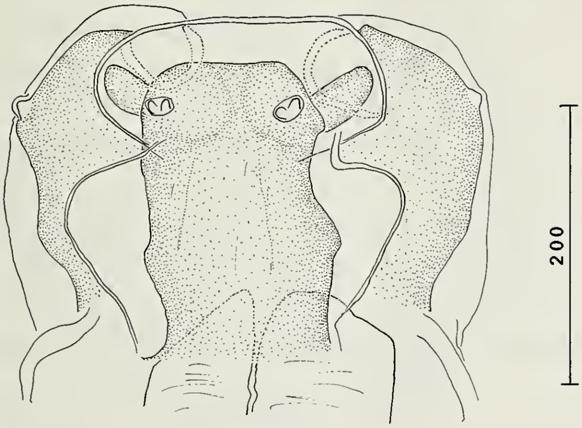
Figs. 57–63. *Hysterothylacium corrugatum*: **57,** Dorsal view of lips; **58,** Ventral view of lips showing interlabium; **59,** *En face*; **60,** Posterior end of male showing modified annules and postanal and para-anal papillae, ventral view; **61,** Posterior end of male showing postanal and para-anal papillae, lateral view; **62,** Posterior end of female tail, lateral view; **63,** Posterior end of male showing entire view of spicules, lateral view.



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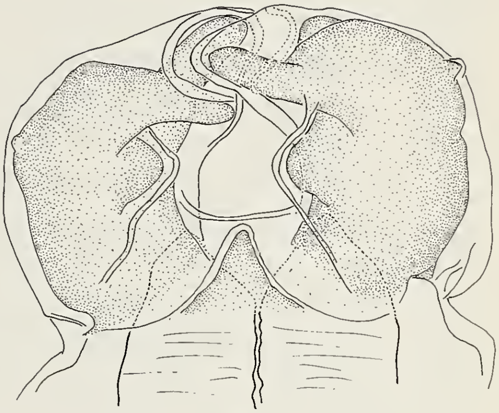

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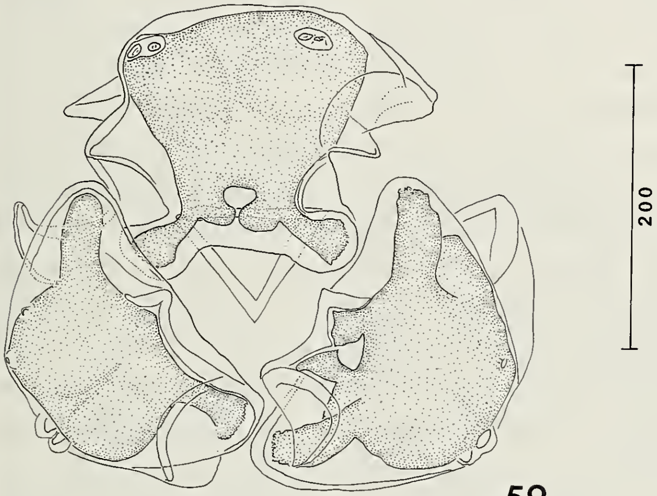

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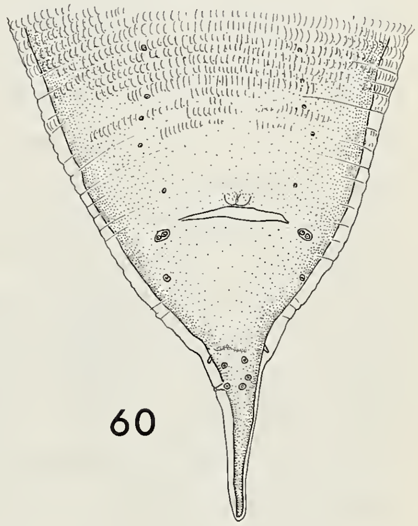

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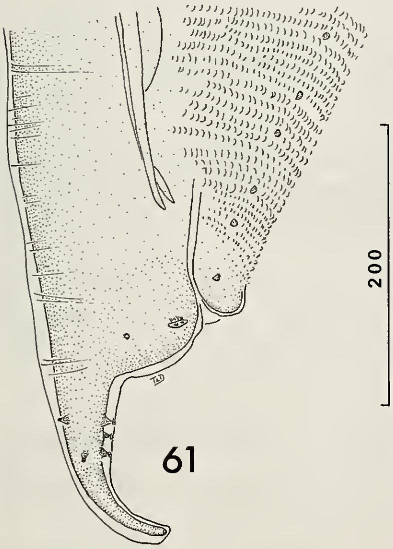

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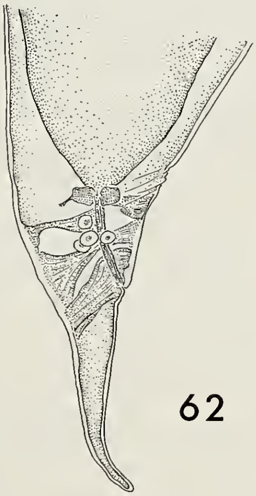

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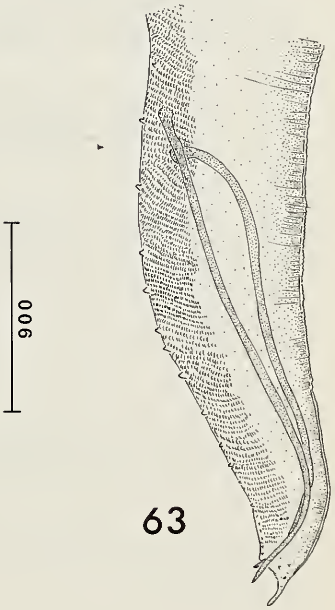

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posteriorly in both lateral cords. Spicules similar and approximately equal. Gubernaculum absent. Lateral row of caudal papillae in addition to regular pre- and postanal papillae. Medioventral preanal organ present. Vulva anterior to midbody. Uterus didelphic, opisthodelphic. Tail conical. Phasmids present. Parasites of marine fish. Type-species: *Iheringascaris iheringascaris* Pereira, 1935 (junior synonym of *I. inquies,* see below).

Comparisons: *Iheringascaris* has long been considered a junior synonym of *Thynnascaris* or its synonym *Contracaecum* (Johnston and Mawson, 1945). Its only species can be easily differentiated from those of *Hysterothylacium* by possessing distinctly plicated cuticular annulations and an additional lateral pair of caudal papillar rows. However, *H. cornutum* does have irregular lateral papillae extending anteriorly and posteriorly from the anal level. Once all species of *Hysterothylacium* are more critically evaluated, they may additionally differ if none have a similar excretory system.

Biological differences may also occur between *I. inquies* and species of *Hysterothylacium*. Adult *I. inquies* live abundantly free in the lumen of the pyloric ceca. Those in the stomach occur free, entwined in digesting prey, and embedded in the host's mucosal tissue. Fourth stage larvae embed in nodules generally causing much less host response than do related species of *Goezia* (see Deardorff and Overstreet, 1980). Iversen and Kelley (1974) suggested gastric ulcers invaded by "*Contracaecum* sp.?" in marlin resulted from mechanical injury by sharply pointed food items, possibly aggravated by the nematodes. We observed no *H. incurvum* or any other species of *Hysterothylacium* to embed in the alimentary tract of their hosts. Kalyankar (1972) reported larval *I. inquies* from gills of sea-crabs in Ratnagira, India, but that identification requires confirmation. Adults of *Goezia* are much wider than *I. inquies,* have spines on the plicated annulations, and have angulated overhanging lips.

Iheringascaris inquies (Linton), new combination
Figs. 68–84

Ascaris inquies Linton, 1901:452, pl. 6, figs. 46–50 (original description; type-host *Rachycentron canadum*; type-locality Buzzard's Bay, Massachusetts).

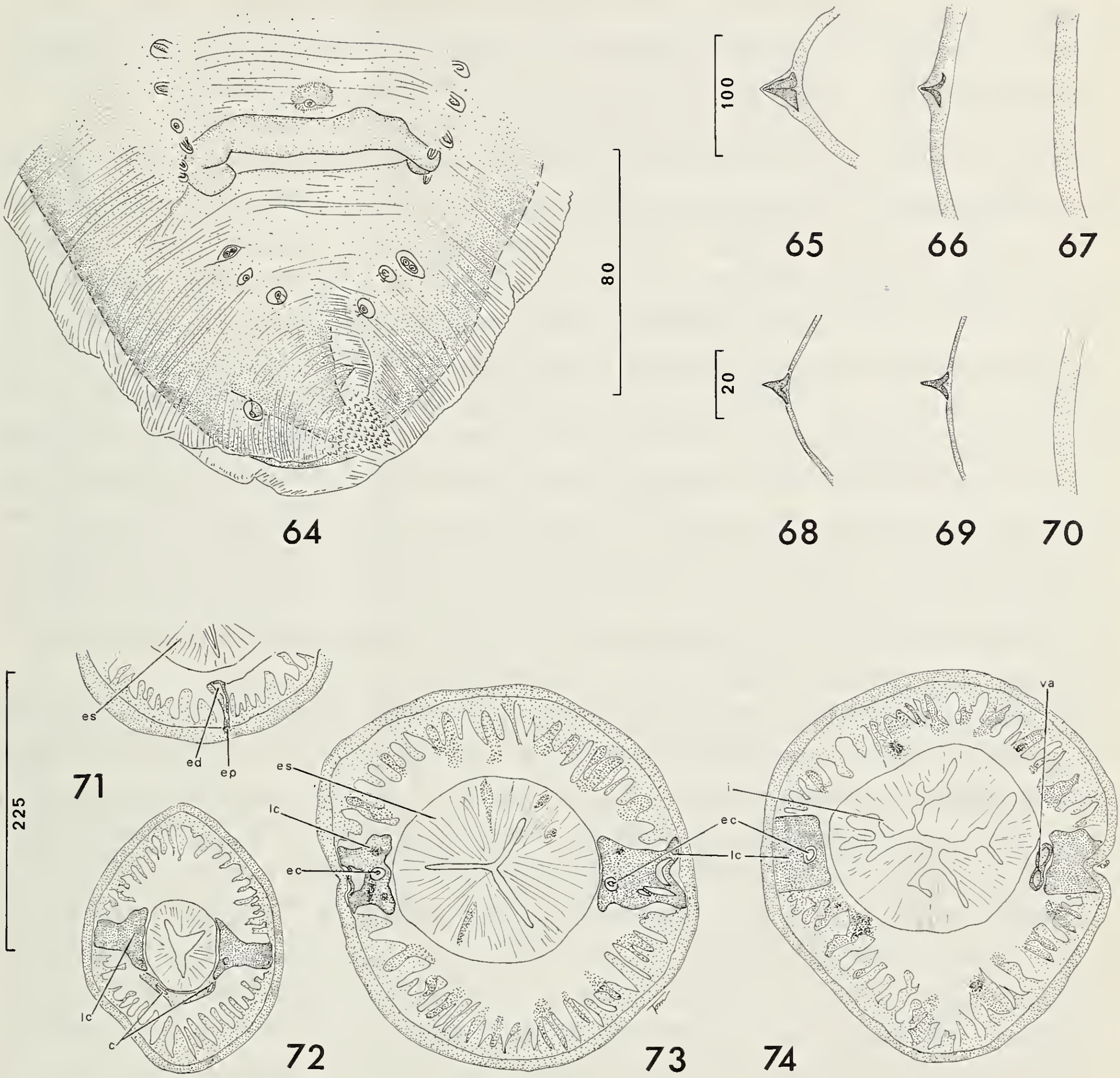
Iheringascaris iheringascaris Pereira, 1935:56–58, figs. 10–16 (original description; type-locality Natal, Estado do Rio Grande do Norte, Brazil).

Contracaecum (*Thynnascaris*) *inquies*.—Johnston and Mawson, 1945:132–133 (new combination).

Thynnascaris iheringascaris.—Hartwich, 1957:240–241 (new combination).

Contracaecum iheringascaris.—Yamaguti, 1961:28, pl. 5, fig. 36 (new combination).

Thynnascaris inquies.—Rasheed, 1965:323–329, figs. 18–28 (new combina-



Figs. 64–74. *Hysterothylacium habena* (**64–67**) and *Iheringascaris inquies* (**68–74**): **64,** Male tail of *H. habena,* ventral view; **65–67,** Lateral ala at anterior (**65**), middle (**66**), and posterior (**67**) parts of female; **68–70,** Lateral ala of *I. inquies* at anterior (**68**) and midbody (**69**) of fourth stage larva and midbody (**70**) of mature male; **71–74,** Cross-sections of excretory system showing excretory pore (**71**), excretory commissure (**72**), and excretory canals immediately anterior to intestinal cecum (**73**), and immediately posterior to esophageal-ventricular junction (**74**). Abbreviations: **c** = commissure, **ec** = excretory canal, **ed** = excretory duct, **ep** = excretory pore, **es** = esophagus, **i** = intestine, **lc** = lateral cord, **va** = ventricular appendage.

tion; redescription based on Linton's specimens and others from Karachi, West Pakistan).

?*Neogoezia elacateiae* Khan and Begum, 1971:12–14, fig. 8 (original description; type-host *Rachycentron canadum* [as *Elacate nigra*]; type-locality Karachi Coast).

Diagnosis.—Cuticle with deep transverse annulations; lips with ratio of length to width 1:1.1–1.6; caudal papillar pairs: preanal 25–29, medial-postanal 6, lateral 6; spicules 23–25% of body length; spicule-ratio 1:0.8–1.2; digitiform process lacking ornamentation on posterior extremity.

General (based on specimens from Mississippi and Alabama).—Body reaching greatest width near midbody. Cuticle with deep transverse annulations along entire length. Lateral alae extremely reduced or absent in adults (relatively prominent in fourth stage larva). Lips approximately equal in size, wider than long; flanges widest near posterior, indented at anterior ⅓; pulp pedunculated. Interlabia with height equal to or slightly greater than width at base; interlabial grooves lacking. Cervical papillae small, near nerve ring. Esophagus 12–15% of body length. Ventriculus narrower than widest level of esophagus, usually longer than broad; ventricular appendage descending without angulation from posterior portion of ventriculus. Nerve ring at anterior 10–23% of esophagus. Excretory pore immediately posterior to level of nerve ring; excretory canal in right lateral cord terminating slightly anterior to level of tip of intestinal cecum; canal in left lateral cord extending considerably farther posteriorly. Tail conical.

Male (based on 20 mature specimens): Body 20–27 mm long by 216–709 at greatest width; ratio of greatest width to length 1:54–94. Lips 72–132 long by 96–144 at greatest width. Nerve ring 204–442 from anterior extremity, 31–55 in breadth. Esophagus 2.0–4.0 mm long by 116–144 wide. Ventriculus 74–166 long by 92–135 wide; ventricular appendage 1.3–1.7 mm long by 50–70 wide; ratio for lengths of ventricular appendage to esophagus 1:1.9–2.5. Intestinal cecum 330–649 long by 75–105 wide; ratio of cecal to ventricular appendage lengths 1:1.7–4.2; ratio of cecal to esophageal lengths 1:5–8. Spicules bifurcate at tip, covered by thin sheath, 23–25% of body length, unequal; left spicule 5.3–9.2 mm long by 12–15 wide; right spicule 5.8–10.7 mm long by 12–15 wide, usually longer than left spicule; spicule ratio 1:0.8–1.2. Caudal papillae 37–41 pairs, becoming closer together and more medial as approaching anus; preanal pairs 25–29; medial-postanal pairs 6 with 3rd from posterior end doubled; lateral pairs 6. Medioventral preanal organ simple, distinct, papillated. Tail flexed ventrad, 79–132 long.

Female (based on 20 mature specimens): Body 14–35 mm long by 253–709 wide; ratio of greatest width to length 1:54–70. Lips 86–127 long by 122–151 wide. Nerve ring 450–550 from anterior extremity, 16–34 in breadth. Esophagus 2.0–3.5 mm long by 80–140 wide. Ventriculus 110–170 long by 62–130 wide; ventricular appendage 1.2–2.0 mm long by 77–105 wide; ratio for lengths of ventricular appendage to esophagus 1:1.6–2.5. Intestinal cecum 260–505 long by 50–100; ratio of cecal to ventricular appendage lengths 1:1.7–4.3; ratio of cecal to esophageal lengths 1:6.0–7.1. Vulva without salient lips, opening 10.0–11.7 mm or 31–38% of body length from anterior extremity. Ovaries rarely extending anteriorly to level of vulva. Eggs 40–60 in diameter. Tail 250–611 long. Phasmids 1 pair, located laterally, equatorially between anus and posterior extremity of tail.

Host.—*Rachycentron canadum* (Linnaeus), cobia (Rachycentridae).

Sites of infection.—Stomach and pyloric ceca.

Localities.—Mississippi Sound, Mississippi; Alabama Point, Alabama; Buzzard's Bay, Massachusetts; Lower Chesapeake Bay, Virginia; Natal, Brazil; and Karachi, West Pakistan.

Specimens deposited.—(2 pairs) USNM Helm. Coll. No. 75847; (1 pair) OCI 31.605; (1 pair) BMNH Reg. No. 1980.367–368.

Remarks.—Linton (1901) originally described *Ascaris inquies* from material removed from the stomach of *Rachycentron canadum* near Woods Hole, Massachusetts. He reported 24 pairs of preanal papillae and 4 pairs of postanal ones. Because Linton's description and illustrations were inadequate, Rasheed (1965) redescribed it using one of Linton's deposited specimens and those removed from the same host species in West Pakistan. She transferred it to *Thynnascaris,* agreed with the presence of 24 pairs of preanal and 4 pairs of medial-postanal papillae, and noted an additional 4 lateral pairs of papillae which Linton had missed. Since the holotype was not available, we examined two male and five female specimens (USNM Helm. Coll. No. 6622) deposited by Linton in 1899 from the type-host and type-locality. On the best male specimen, we counted 6 lateral, 6 medial-postanal, and 24 pairs of preanal papillae. We also examined specimens (VIMS Host No. S-498) from a cobia caught in Lower Chesapeake Bay, off Seaford, Virginia, with similar papillar counts; the doubled papillae were obvious. Our specimens from the northern Gulf of Mexico showed no marked differences with those or with Rasheed's specimens (BMNH 1964.1523–1532) which we also examined and are consequently considered conspecific with them. With the permission of Rodney Bray, Parasitic Worm Section, British Museum (Natural History), we deposited one pair of Rasheed's specimens in the U.S. National Museum (USNM Helm. Coll. No. 75545).

We also examined four specimens, 3 males and 1 female, of *Iheringascaris iheringascaris* loaned to us by J. J. Vicente (OCI No. 17.157) from *R. canadum* in Brazil. Pereira (1935) listed the type-host as "bijupirá" which, according to Vicente, is a common name for *Rachycentron canadum.* The elongated specimens we examined were fragments or had stripped cuticles. Nevertheless, we counted at least 18 pairs of preanal, 6 pairs of medial-postanal, and 6 pairs of lateral papillae and confirmed the characteristic annulations. These features in addition to the measurements in the original description reported by Pereira (1935) prompt us to consider *Iheringascaris iheringascaris* a junior synonym of *I. inquies.*

Species of *Hysterothylacium* purported to possess conspicuous transverse annulations are *H. cornutum* from *Thunnus thynnus* (Linnaeus) (as

T. vulgaris) at Trieste, Italy, and *H. carangis* from the intestine of *Caranx malabaricus* Day at Panjim, India. *Hysterothylacium cornutum* was originally described by Stossich (1904), and Baylis (1923) later added to that description using Stossich's original material. Baylis noted that the cuticular striations had "rather prominent edges, like minute sawteeth." We examined these specimens of *H. cornutum,* 2 males and 2 females (BMNH No. 1931.10.20.80–89), but observed fine cuticular annules such as typically seen on adult specimens of some species of *Hysterothylacium.* Kalyankar (1971) stated that the striations of *H. carangis* were "not so distinct at the anterior and posterior extremities of the male, but very distinct in the middle of the body." In female specimens these striations were apparently very distinct with the exception of the "anterior-most region." Cuticular annulations of *I. inquies* are consistently conspicuous at all regions of both male and female worms. *Hysterothylacium carangis* is reported to have 28 caudal papillae in contrast to the 36–42 on *I. inquies.* Kalyankar purported two spicules of equal length; yet, his illustration showed the left spicule slightly longer than the right. In *I. inquies* the right is usually slightly longer than the left. Kalyankar stated that *H. carangis* differed from *I. inquies* by possessing a straight blunt tail and a postequatorial vulva. *Hysterothylacium carangis* needs critical reexamination. In any event, *I. inquies* differs from *H. cornutum* and apparently from *H. carangis.*

Khan and Begum (1971) described *Neogoezia elacateiae* from *Elacate nigra* (Day) (=*Rachycentron canadum*) off the coast of Karachi, West Pakistan. That host and locality are the same as Rasheed reported for *H. inquies.* Also, those authors' description and illustrations show the conspicuous transverse cuticular annulations and other diagnostic features of *I. inquies.* They, however, did not observe interlabia or a ventricular appendage, and they reported 11 preanal papillae without mentioning lateral, para- or postanal papillae. To date we have been unsuccessful in corresponding with Khan. Consequently, until Khan and Begum's specimens can be reexamined, we suggest that *Neogoezia elacateiae* may be a junior synonym of *I. inquies.*

In addition to the previous diagnoses, the following key should permit

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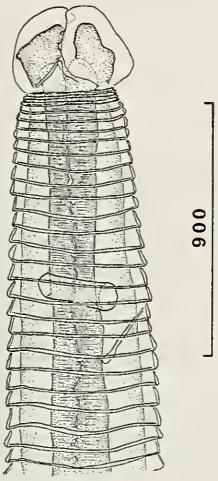
Figs. 75–84. *Iheringascaris inquies*: **75,** Anterior end showing conspicuous annulations and spacial relationship between excretory pore and nerve ring, lateral view; **76,** Dorsal view of lips; **77,** Ventral view of lips showing interlabium; **78,** Posterior extremity of female tail, lateral view; **79,** *En face*; **80,** Male tail showing lateral and medial postcloacal papillae, ventral view; **81,** Tip of spicule, lateral view; **82,** Body at level of intestinal-ventricular junction, lateral view; **83,** Female tail, lateral view; **84,** Posterior end of male showing caudal papillae, lateral view. (Portions of the annulations in Figs. 80, 83, and 84 were omitted for clarity of other structures.)



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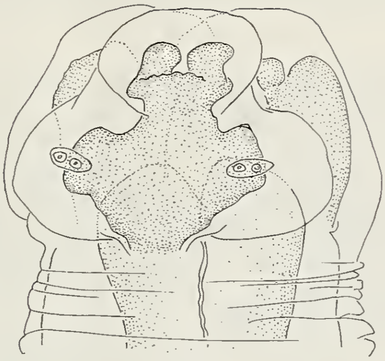

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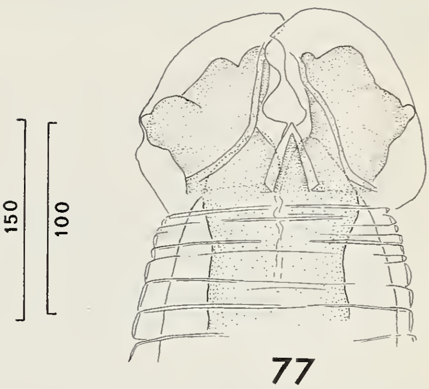

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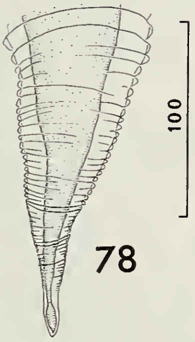

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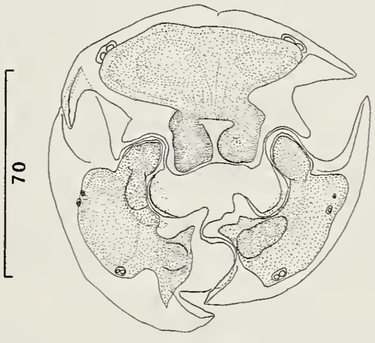

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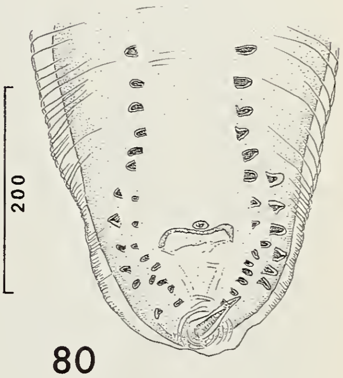

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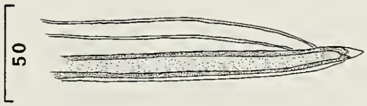

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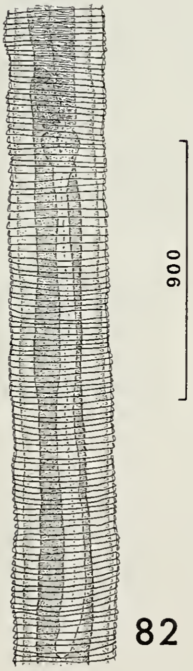

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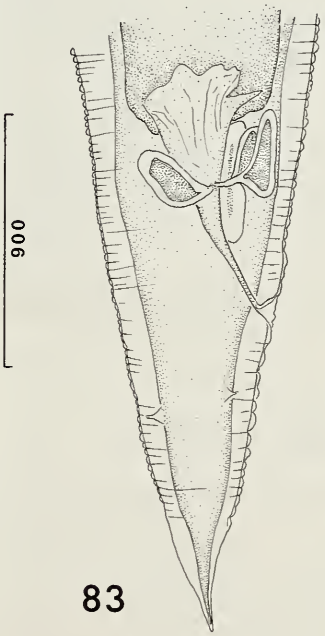

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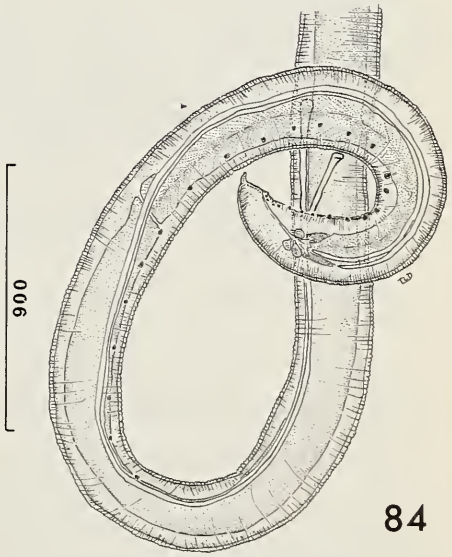

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rapid identification of adults of species of *Hysterothylacium* reported in this paper.

Key to the Species of *Iheringascaris* and *Hysterothylacium* Parasitizing Fishes in the Northern Gulf of Mexico

1. Cuticle with deep transverse annulations (Fig. 75); 25–29 pairs of preanal, 6 pairs of medial-postanal, and 6 pairs of lateral-postanal papillae. Host: *Rachycentron canadum.* Western North Atlantic and Gulf of Mexico (also Brazil and Pakistan) .... *I. inquies* (Linton, 1901)
– Cuticle lacking deep transverse annulations **2**
2. Cervical alae prominent (Figs. 1, 4); 16–25 pairs of preanal, 8 pairs of postanal, and no para-anal papillae; tuft of spinous-like projections at posterior extremity. Hosts: *Scomberomorus brasiliensis, S. maculatus, S. cavalla,* and *Oligoplites saurus.* Gulf of Mexico (also Atlantic coasts of Florida and Brazil) .... *H. fortalezae* (Klein, 1973)
– Cervical alae not prominent **3**
3. Cuticle with ventral crests (enlarged, modified annules [Figs. 50–52]) anterior to anus on male **4**
– Cuticle lacking ventral crests on males **5**
4. Interlabial grooves deep (Figs. 47, 48); spicules 12–25% of body length. Hosts: *Xiphias gladius* and *Tetrapturus albidus* plus other marlin. Gulf of Mexico (also in Baltic Sea and off Floridian Atlantic coast, India, Tanzania, and probably Japan, New Zealand, and elsewhere) .... *H. incurvum* (Rudolphi, 1819)
– Interlabial grooves lacking; spicules 4–7% of body length. Host: *Xiphias gladius.* Gulf of Mexico (also off Floridian Atlantic coast and Ecuador) .... *H. corrugatum,* sp. n.
5. Tail tip with relatively large projections on tuft (Figs. 42, 45); 23 pairs of preanal and 7 pairs of postanal papillae; pulp of lips not pedunculate. Host: *Chaunax pictus.* Gulf of Mexico .... *H. chaunaxi* (Olsen, 1952)
– Tail tip with dense covering of minute spinous structures or lacking ornamentation **6**
6. Lateral flanges of lips indented equatorially (Figs. 22–24); spicules 3–8% of body length; multispinous conical process at posterior extremity. Hosts: numerous fishes (see text). Gulf of Mexico (also Pacific and Caribbean coasts of Central America and Atlantic coast of South America to Brazil) .. *H. reliquens* (Norris and Overstreet, 1975)
– Lateral flanges of lips indented at anterior ⅓ of lip (Figs. 14, 15); length of spicules 1–2% that of body; digitiform process on posterior extremity of tail lacking ornamentation. Hosts: *Ogcocephalus ra-*

diatus and *O. cubifrons*. Gulf of Mexico (and Floridian Atlantic coast)
.... *H. ogcocephali* (Olsen, 1952)

Acknowledgments

We gratefully acknowledge the assistance of the following persons: D. I. Gibson and R. A. Bray for loaning specimens deposited in the British Museum (Natural History); G. Hartwich at the Zoologisches Museum, for loaning syntypes of *H. incurvum*; J. R. Lichtenfels for loaning specimens deposited in the U.S. National Museum Helminthological Collection; C. D. Dawson (GCRL) for permission to remove worms from stomachs of several museum hosts; B. B. Collette at the National Marine Fisheries Service Systematics Laboratory (USNM) for most specimens of *H. reliquens* from *Batrachoides* spp.; C. T. Fontaine previously at NMFS Biological Laboratory of Galveston, Texas, for specimens of *H. reliquens* from *Arius felis*; R. G. Yaeger at Tulane University School of Medicine for specimens of *H. reliquens* collected off the R/V OREGON II (we also thank the NMFS Laboratory at Pascagoula, Mississippi, for these plus samples of uninfected Atlantic croaker from offshore in the Gulf of Mexico); J. J. Vicente at the Oswaldo Cruz Institute for loaning specimens of *I. iheringascaris* and *H. fortalezae*; E. M. Burreson at Virginia Institute of Marine Science for providing specimens of *I. inquies*; D. E. Norris at University of Southern Mississippi for providing specimens of *H. habena*; P. J. Pristas at NOAA, NMFS (Panama City Laboratory) for aid in collecting white marlin; C. A. Hamilton and Mobile Big Game Fishing Club, Orange Beach, Alabama, and Pflueger Marine Taxidermist, Hallandale, Florida, for providing cooperation, space, and permission to examine billfish collected by sportsfishermen; E. W. Cake and T. E. Mattis of GCRL, S. H. Deardorff and L. A. Covington of Ocean Springs, Mississippi, and F. Crooke of Pensacola, Florida, for aiding in the collection of hosts and parasites; and R. Buxton, J. D. Durfee, R. G. Palmer, R. A. Krol, and K. E. Richards for technical assistance.

This study was conducted in cooperation with the U.S. Department of Commerce, NOAA, National Marine Fisheries Service, under PL 88-309 Project No. 2-325-R and HEW/Public Health Service, Food and Drug Administration Contract No. 223-76-2141.

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Gulf Coast Research Laboratory, Ocean Springs, Mississippi 39564.